ORTEC®

MAESTRO®-32

MCA Emulator for
Microsoft® Windows® 98 SE, 2000 Pro, and XP® Pro

A65-B32
Software User's Manual

Software Version 6.0

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Advanced Measurement Technology, Inc.

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NOTE!

We assume that you are thoroughly familiar with 32-bit Microsoft® Windows® usage and terminology. If you are not fully acquainted with the Windows environment, including the use of the mouse, we strongly urge you to read the Microsoft documentation supplied with your Windows software and familiarize yourself with a few simple applications before proceeding.

The convention used in this manual to represent actual keys pressed is to enclose the key label within angle brackets; for example, **<F1>**. For key combinations, the key labels are joined by a + within the angle brackets; for example, **<Alt + 2>**.

INSTALLATION

If you are installing a new multichannel buffer (MCB) in addition to **MAESTRO-32**, or if your MCB and/or new **MAESTRO-32** is accompanied by a ***CONNECTIONS-32*** Driver Update Kit (Part No. 797230), follow the installation instructions that accompany the driver update kit.

For information on installation and configuration, hardware driver activation, network protocol configuration, and building the master list of instruments accessible within **MAESTRO-32**, see Chapter 2 (page 7) and the accompanying ***ORTEC MCB CONNECTIONS-32 Hardware Property Dialogs Manual***.

1. INTRODUCTION

Welcome to MAESTRO-32 Version 6. This latest release extends the capabilities of the world's most popular multichannel analyzer (MCA) emulation software with the addition of a command that gives you the option of using a multi-detector interface that lets you view up eight MCA windows and eight buffer windows at a time, or using the "classic," single-window interface. In addition, the revised installation wizard provides more guidance in selecting the instrument drivers you will need. MAESTRO-32 V6 uses the GammaVision library editor so you can now create, modify, and use both **.LIB**- and **.MDB**-format (NuclideNavigator®) libraries. This release of MAESTRO also supports our new DSPEC Pro™, DSPEC jr 2.0™, Detective™, Detective-EX™, and trans-SPEC™ instruments.

1.1. MCA Emulation

An MCA, in its most basic form, is an instrument that sorts and counts events in real time. This sorting is based on some characteristic of these events, and the events are grouped together into bins for counting purposes called *channels*. The most common type of multichannel analysis, and the one which is of greatest interest to nuclear spectroscopists, is *pulse-height analysis* (PHA). PHA events are signal pulses originating from a detector.[1] The characteristic of interest is the pulse height or voltage, which is proportional to the particle or photon energy. An *analog-to-digital converter* (ADC) is used to convert each pulse into a channel number, so that each channel corresponds to a narrow range of pulse heights or voltages. As pulses arrive over time, the MCA collects in memory a distribution of the number of pulses with respect to pulse height (a series of memory locations, corresponding to ADC channels, will contain the number of pulses of similar, although not necessarily identical, height). This distribution, arranged in order of ascending energies, is commonly referred to as a *spectrum.* To be useful, the acquired spectrum must be available for storage and/or analysis, and is displayed on a graph whose horizontal axis represents the height of the pulse and whose vertical axis represents the number of pulses at that height, also referred to as a *histogram.*

MAESTRO-32, combined with *multichannel buffer* (MCB) hardware and a personal computer, emulates an MCA with remarkable power and flexibility. The MCB performs the actual pulse-height analysis, while the computer and operating system make available the display facility and data-archiving hardware and drivers. The MAESTRO software is the vital link that marries these components to provide meaningful access to the MCB via the user interface provided by the computer hardware.

The MAESTRO-32 MCA emulation continuously shows the spectrum being acquired, the current operating conditions, and the available menus. All important operations that need to be

[1] In this manual "Detector" (capitalized) means the transducer (high-purity germanium, sodium iodide, silicon surface barrier, or others) plus all the electronics including the ADC and histogram memory. The transducers are referenced by the complete name, e.g., high-purity germanium (HPGe) detector.

performed on the spectrum, such as peak location, insertion of *regions of interest* (ROIs), and display scaling and sizing are implemented with both the keyboard (accelerators) and mouse (toolbar and menus). Spectrum peak searching, report generation, printing, archiving, calibration, and other analysis tools are available from the menus. Some menu functions have more than one accelerator so that both new and experienced users will find the system easy to use. This version of MAESTRO continues to offer the flexibility of constructing automated sequences or "job streams."

Buffers are maintained in the computer memory to which one spectrum can be moved for display and analysis, either from Detector memory or from disk, while another spectrum is collected in the Detector. As much as possible, the buffer duplicates in memory the functions of the Detector hardware on which a particular spectrum was collected. Data can also be analyzed directly in the Detector hardware memory, as well as stored directly from the Detector to disk. This release of MAESTRO allows you to open up to eight Detector windows and eight buffer windows simultaneously.

MAESTRO-32 uses the network features of Windows so you can use and control ORTEC MCB hardware anywhere on the network.

1.2. About This User Manual

This manual is intended to be used in conjunction with the *ORTEC MCB **CONNECTIONS-32** Hardware Property Dialogs Manual* (Part No. 931001, hereinafter called the "MCB Properties manual") included with MAESTRO. The hardware property dialogs manual contains the hardware setup information for our ***CONNECTIONS***-compliant MCBs (these dialogs are discussed in more detail in Section 4.2.7). In addition, it provides detailed instructions on installing ***CONNECTIONS*** software, building the *Master Instrument List* of all ORTEC MCBs connected to your PC locally and across a network, and selecting the proper protocol for communicating with networked ORTEC instruments.

1.3. PC Requirements

MAESTRO-32 (A65-B32) is designed for use on PCs that run Microsoft Windows 98 SE, 2000 Pro, and XP Pro. For PCs with a memory-mapped MCB interface, no other interface can use memory mapped into page D of the PC memory map (see the MCB Properties manual). Data can be saved or retrieved from any number of removable or fixed drives.

1.4. Detectors

Front-end acquisition hardware supported includes ORTEC's ***CONNECTIONS-32***-compliant MCBs interfaced to the computer with an appropriate adapter card and cable, or using the printer-port adapter. In a network, the ORSIM™ III can also be used to connect MCBs directly to the Ethernet.

MAESTRO-32 can control and display an almost unlimited number of Detectors, either local or networked; the limit depends on system resources. These can be any mixture of the following types of units, properly installed and hardware-configured: DSPEC Pro™, DSPEC jr 2.0™, Detective™, Detective-EX™, trans-SPEC™, digiBASE™, microBASE™, DSP-Scint™, digiDART™, DSPEC Plus™, DSPEC jr™, Models 916A, 917, 918A, 919, 920, 921, 926, 919E, 920E, 921E, 92X, 92X-II, NOMAD™ Plus, NOMAD, MicroNOMAD®, OCTÊTE® PC, TRUMP™, MicroACE™, DART®, DSPEC, MatchMaker™, M^{3}CA, MiniMCA-166, and other new modules. MAESTRO-32 will correctly display and store a mixture of different sizes of spectra. Multiple MAESTRO windows can be open at one time, displaying Detectors, buffers, spectrum files from disk, and data analyses. The larger and higher-resolution your monitor, the more windows you can comfortably view.

Expanding the system for more Detectors (as well as enabling more than one device on a Model 919) is easy. When the system incorporates a Model 920- or OCTÊTE PC-type MCB, the system can also be expanded using the internal multiplexer/router. In the Model 920 or OCTÊTE PC, the MCB memory is divided into *segments* so that each input has an equal share of the MCB memory, the size of which matches the conversion gain or maximum channel number of the ADC. Note that in the multiple-input MCBs like the Model 919 or Model 920, all inputs are treated as different Detectors. Therefore, all ***CONNECTIONS*** software will address one physical 919 unit as four distinct Detectors.

1.5. Detector Security

Detectors can be protected from destructive access by password. If your application supports detector locking and unlocking, passwords can be set within the application. Once a password is set, no application can start, stop, clear, change presets, change ROIs, or perform any command that affects the data in the detector if the password is not known. The current spectrum and settings for the locked device can be viewed read-only. The password is required for any destructive access, even on a network. This includes changing instrument descriptions and IDs with the MCB Configuration program.

1.6. Enhancements to MAESTRO for Windows

1.6.1. MAESTRO-32 V6.04 vs. V6

1. The new **Multiple Windows** command, on the Window menu, lets you choose between the newer multiple-detector-window mode and the original single-detector-window mode.

2. MAESTRO no longer supports operation with Microsoft Windows 95, NT or the earliest release of Windows 98 (as distinguished from Windows 98 Second Edition, which is still supported).

3. Support has been added for the new ORTEC DSPEC Pro, DSPEC jr 2.0, Detective, Detective-EX, and trans-SPEC MCBs.

1.6.2. MAESTRO-32 V6 vs. V5.35

1. MAESTRO now has a multi-detector interface that allows you to open up to eight Detector windows and eight buffer windows simultaneously.

2. Support has been added for the new ORTEC digiBASE, microBASE, and DSP-Scint MCBs.

3. The list of library peaks can be sorted by clicking on the column header.

4. MAESTRO now uses the same library editor as GammaVision-32®, so both **`.LIB`**- and **`.MDB`**-format libraries can be created, modified, and used within the program. The old MAESTRO **`.MCA`** library file format is no longer supported.

1.6.3. MAESTRO-32 V5.35 vs. V5.3

1. Support for Windows XP Pro has been added.

2. Operation with Windows 95 is not guaranteed.

3. The DSPEC jr is supported on the USB port.

4. Support for SP3 of Windows 2000 has been added.

1.6.4. MAESTRO-32 V5.3 vs. V5.

1. The digiDART portable MCA is supported on the USB port.

2. The MCB presets and controls have been moved into a single menu control, **MCB Properties**. This makes all the MCB controls more uniform and more in line with other Windows programs.

3. Isotope markers have been added. The isotope markers show all the gamma rays of a single nuclide (from the library) on the spectrum displays when any one of the gamma rays from that nuclide is selected on the spectrum. The amplitude of the marker for the selected peak is proportional to the peak area. The amplitude of the marker for the other peaks is proportional to the first peak and the branching ratio.

4. Support for the SBS60 has been added. The SBS60 is a single ISA card spectrometer intended for use in Safeguards applications.

5. Support for Windows 2000 Pro has been added.

2. INSTALLING MAESTRO-32

If your MAESTRO CD is accompanied by a ***CONNECTIONS-32*** Driver Update Kit (Part No. 797230), follow the installation instructions that accompany the update kit, which supersede the instructions below.

NOTE For systems using Windows 2000 or XP, ORTEC ***CONNECTIONS-32*** software products are designed to operate correctly only for users with full Administrator privileges. Limiting user privileges could cause unexpected results.

1) Insert the MAESTRO-32 CD. If it does not autorun, go to the Windows Taskbar and click on **Start**, then **Run...**. In the Run dialog, enter `D:\Disk 1\Setup.exe` (use your CD-ROM drive designator instead of `D:`), then click on **OK**. This will start the installation wizard; click on **Next** and follow the wizard prompts.

2) On the Instrument Setup page, mark the checkbox(es) that corresponds to the instrument(s) installed on your PC, as shown in Fig. 1. To see more information on each instrument family, click on the family name and read the corresponding **Item Description** on the right side of the dialog.

   If this is a MAESTRO upgrade and not a first-time installation, you probably already have ORTEC ***CONNECTIONS-32*** instruments attached to your PC. If so, they will be included on the **Local Instrument List** at the bottom of the dialog, along with any new instruments. Existing (previously configured before this upgrade) instruments do not have to be powered on during this part of the installation procedure.

   NOTE You can enable other device drivers later, as described in Section 2.2.

3) If you want other computers in a network to be able to use your MCBs, leave the **Allow other computers to use this computer's instruments** marked so the MCB Server program will be installed. Most users will leave this box marked for maximum flexibility.

   NOTE If your PC uses Windows XP and you wish to use or share ORTEC MCBs across a network, ***be sure to read Section 2.1***.

4) Click on **Done**.

   If your PC is operating under Windows 2000 or XP, the installation wizard will resume copying files.

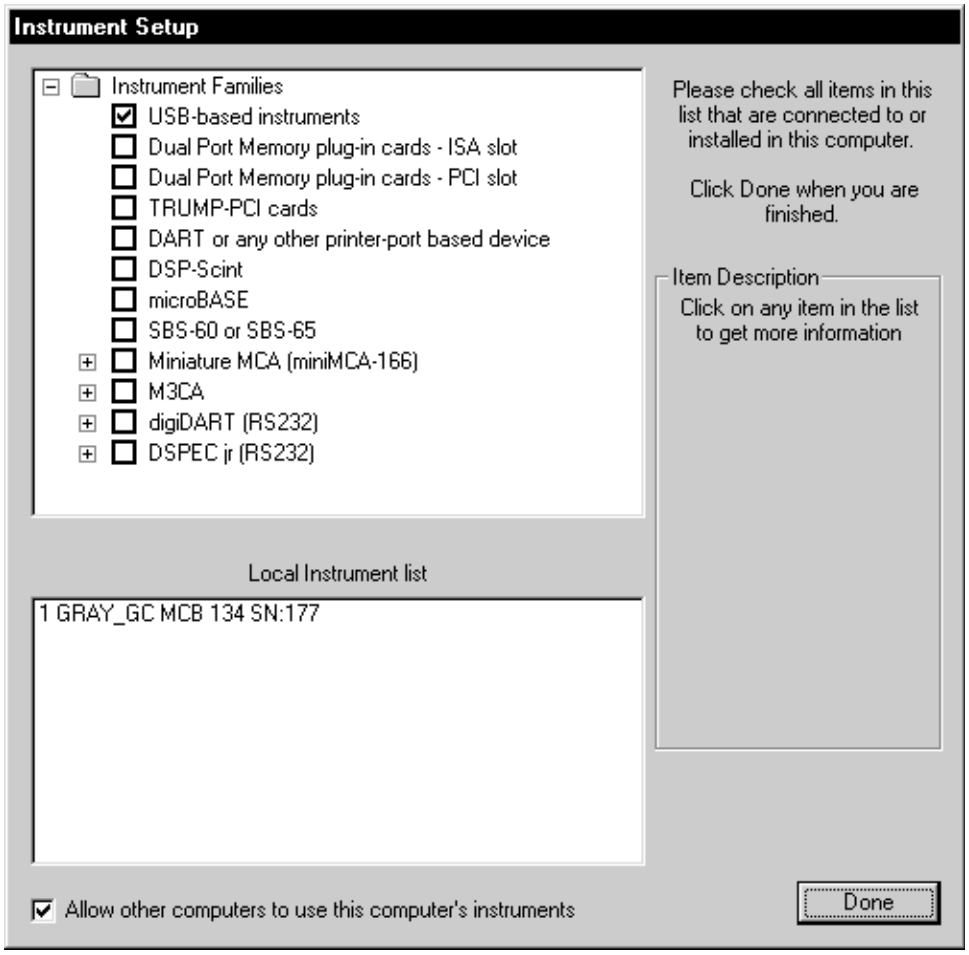

Instrument Setup
Instrument Families
USB-based instruments
Dual Port Memory plug-in cards - ISA slot
Dual Port Memory plug-in cards - PCI slot
TRUMP-PCI cards
DART or any other printer-port based device
DSP-Scint
microBASE
SBS-60 or SBS-65
Miniature MCA (miniMCA-166)
M3CA
digiDART (RS232)
DSPEC jr (RS232)
Please check all items in this list that are connected to or installed in this computer.
Click Done when you are finished.
Item Description
Click on any item in the list to get more information
Local Instrument list
1 GRAY_GC MCB 134 SN:177
Allow other computers to use this computer's instruments
Done

Fig. 1. Choose the Interface for Your Instruments.

If your PC uses Windows 98 SE, two additional dialogs might be displayed. The first, shown in Fig. 2, might ask you to insert the "ORTEC Installation CD". *Ignore this message* and click on **OK**.

Fig. 2. Window Menu.

The second additional dialog could request a specific file (see the example in Fig. 3). Browse to the **`c:\Program Files\Common Files\ORTEC Shared\UMCBI`** folder (*not to the MAESTRO CD*), then click on **OK**. The installation wizard will resume copying files.

Fig. 3. Window Menu.

5) At the end of the wizard, restart the PC. Upon restart, remove the MAESTRO CD from the drive.

6) After all processing for new plug-and-play devices has finished, you will be ready to configure the MCBs in your system. Connect and power on all local and network ORTEC instruments that you wish to use, as well as their associated PCs. Otherwise, the software will not detect them during installation. Any instruments not detected can be configured at a later time.

7) If any of the components on the network is a DSPEC Plus, ORSIM II or III, MatchMaker, 9DSPEC, 92X-II, 919E, 920E, 921E, or other module that uses an Ethernet connection, the network default protocol must be set to the **IPX/SPX Compatible Transport with NetBIOS** selection on all PCs that use ***CONNECTIONS*** hardware. For instructions on making this the default, see the network protocol setup discussion in the MCB Properties Manual..

8) To start the MCB Configuration program on your PC, click on **Start**, **Programs**, **MAESTRO 32**, and **MCB Configuration**. Alternatively, you can go to **`c:\Program Files\Common Files\ORTEC Shared\Umcbi`** and run **`MCBCON32.EXE`**. The MCB Configuration program will locate all of the (powered-on) ORTEC MCBs attached to the local PC and to (powered-on) network PCs, display the list of instruments found, allow you to enter customized instrument numbers and descriptions, and optionally write this configuration to those other network PCs, as described in detail in the software installation

chapter of the MCB Properties manual. *If this is the first time you have installed ORTEC software on your system, be sure to refer to the MCB Properties manual for information on initial system configuration and customization*.

MAESTRO-32 is now ready to use, and its MCB pick list can be tailored to a specific list of instruments (see Section 4.4.5).

2.1. If You Have Windows XP Service Pack 2 and Wish to Share Your Local ORTEC MCBs Across a Network

NOTE If you do not have instruments connected directly to your PC or do not wish to share your instruments, this section does not apply to you.

If you have installed Windows XP Service Pack 2 and have fully enabled the Windows Firewall, as recommended by Microsoft, the default firewall settings will prevent other computers from accessing the ***CONNECTIONS-32*** MCBs connected directly to your PC. To share your locally connected ORTEC instruments across a network, you must enable **File and Printer Sharing** on the Windows Firewall Exceptions list. To do this:

1. From the Windows Control Panel, access the **Windows Firewall** entry. Depending on the appearance of your Control Panel, there are two ways to do this. Either open the **Windows Firewall** item (if displayed); or open the **Network Connections** item then choose **Change Windows Firewall Settings**, as illustrated in Fig. 4. This will open the Windows Firewall dialog.

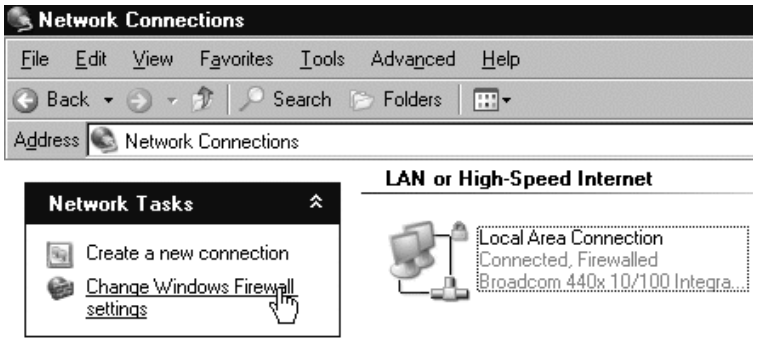


Fig. 4. Change the Firewall Settings.

2. Go to the Exceptions tab, then click to mark the **File and Printer Sharing** checkbox (Fig. 5).

   NOTE This affects only the ability of other users on your network to access your MCBs. You are *not required* to turn on **File and Printer Sharing** in order to access networked MCBs (as long as those PCs are configured to grant remote access).

3. To learn more about exceptions to the Windows Firewall, click on the **What are the risks of allowing exceptions** link at the bottom of the dialog.

4. Click on **OK** to close the dialog. No restart is required.

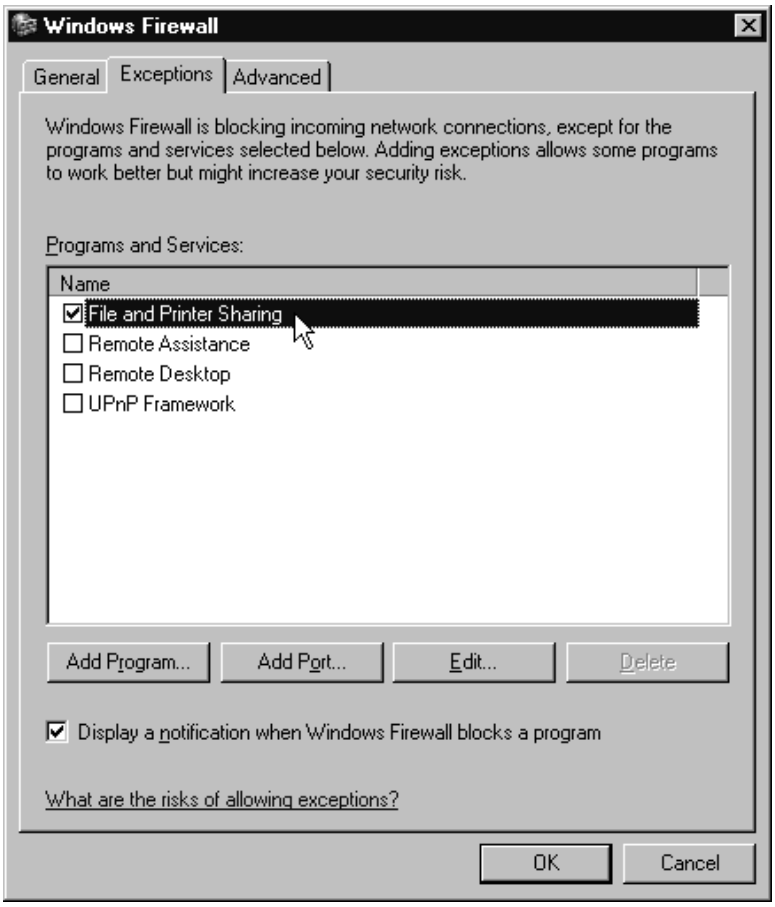


Fig. 5. Turn on File and Printer Sharing.

2.2. Enabling Additional ORTEC Device Drivers

You can enable other device drivers later with the Windows **Add/Remove Programs** utility on the Control Panel. Select **Connections 32** from the program list, choose **Add/Remove**, then elect to **Modify** the software setup. This will reopen the Instrument Setup dialog so you can mark or unmark the driver checkboxes as needed, close the dialog, then re-run the MCB Configuration program as described in Step 8 on page 9.

3. GETTING STARTED

This chapter tells how to start MAESTRO, explains its display features, discusses the role of the mouse and keyboard, covers the use of the Toolbar and sidebars, discusses how to change to different disk drives and folders, and shows how to use additional features such as Help.

3.1. Startup

To start MAESTRO, click on **Start** on the Windows Taskbar, then on **Programs**, **MAESTRO 32**, and **MAESTRO for Windows** (see Fig. 6). You can also start MAESTRO by clicking on **Start**, **Run...**, and entering a command line in the **Run** dialog, with or without arguments, as described in Section A.1.

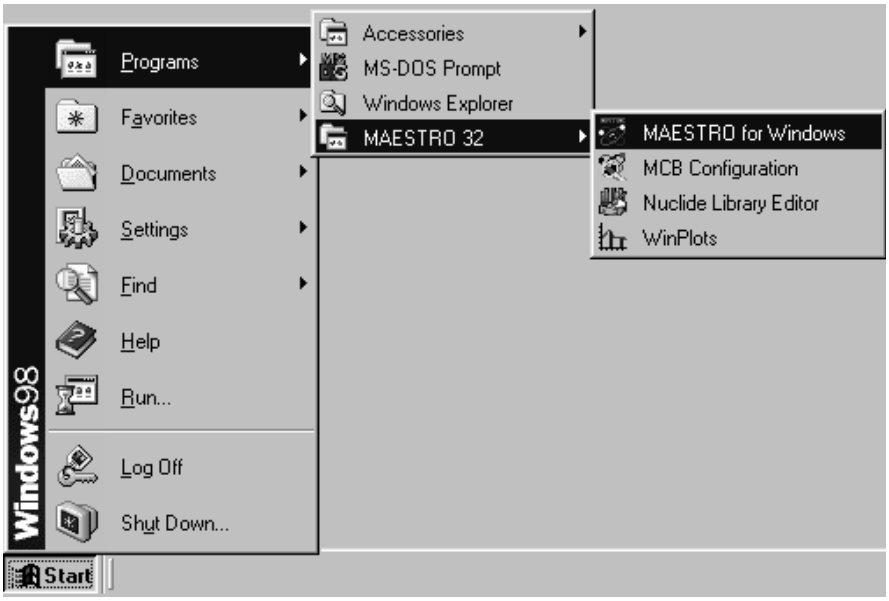


Fig. 6. Starting MAESTRO.

3.2. Screen Features

Figure 7 shows MAESTRO's principal screen features:

1. **Title bar**, showing the program name and the source of the currently active spectrum window. There is also a title bar on each of the spectrum windows showing the source of the data: either the Detector name or the word "Buffer" with the spectrum name. On the far right are the standard Windows Minimize, Maximize, and Close buttons.

2. **Menu Bar**, showing the available menu commands (which can be selected with either the mouse or keyboard); these functions are discussed in detail in Chapter 4.

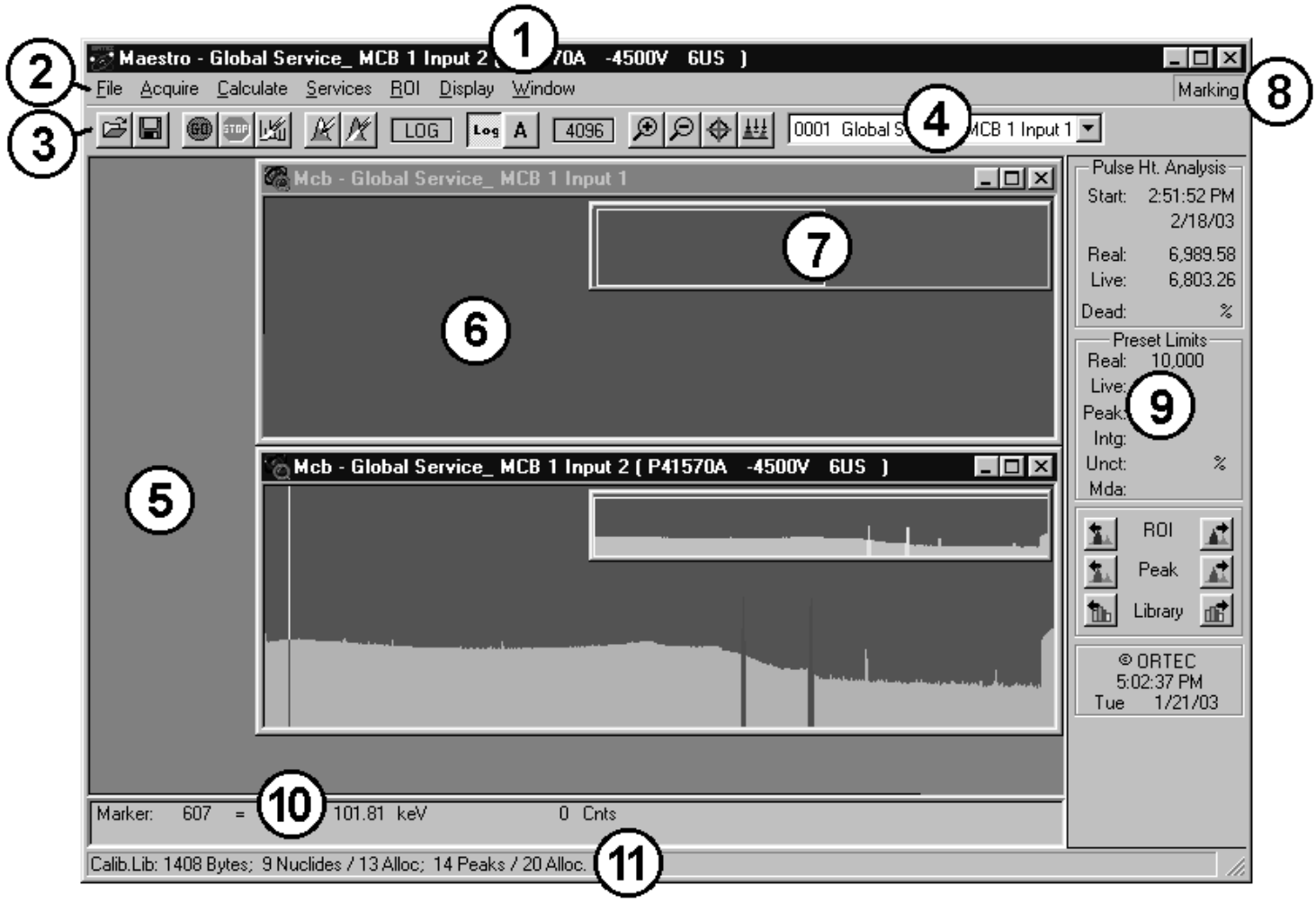


Fig. 7. Main MAESTRO Screen Features.

3. **Toolbar**, beneath the Menu Bar, containing icons for recalling spectra, saving them to disk, starting and stopping data acquisition, and adjusting the vertical and horizontal scale of the active spectrum window.

4. **Detector List**, on the Toolbar, displaying the currently selected Detector (or the buffer). Clicking on this field opens a list of all Detectors currently on the PC's MAESTRO Detector pick list, from which you can open Detector and/or buffer windows. When you select the buffer or a Detector from the list, a new spectrum window opens, to a limit of eight. If you selected a Detector, the spectrum in its memory (if any) is displayed.

5. **Spectrum Area**, which displays multiple *spectrum windows* — up to eight Detector windows and eight buffer windows simultaneously. When you attempt to open a ninth spectrum or buffer window, MAESTRO will ask if you wish to close the oldest window of that type. Alternatively, you can turn off the **Multiple Windows** feature and run in the original one-window-at-a-time mode.

Spectrum windows can be moved, sized, minimized, maximized, and closed with the mouse, as well as tiled horizontally or vertically from the **Window** menu. When more than one window is open, only one is active — available for data manipulation and analysis — at a time. The title bar on the active window will normally be a brighter color than those on the inactive windows (the color scheme will depend on the desktop colors you have selected in Windows Control Panel). Detector windows or buffer windows containing a spectrum from an MCB will list the Detector name on the title bar. If you have opened a spectrum file into a buffer window, the title bar will display the filename. To switch windows, click on the window that you wish to activate, use the **Window** menu (see Section 4.7), or cycle between windows by pressing **<Ctrl + Tab>**.

Each spectrum window contains a **Full Spectrum View** and an **Expanded Spectrum View** (see items 6 and 7 below).

6. The **Full Spectrum View** shows the full histogram from the file or the Detector memory. The vertical scale is always logarithmic, and the window can be moved and sized (see Section 3.5.4). The Full Spectrum View contains a rectangular window that marks the portion of spectrum now displayed in the Expanded Spectrum View (see Fig. 8). To quickly move to different part of the spectrum, just click on that area in the Full Spectrum View and the expanded display updates immediately at the new position.

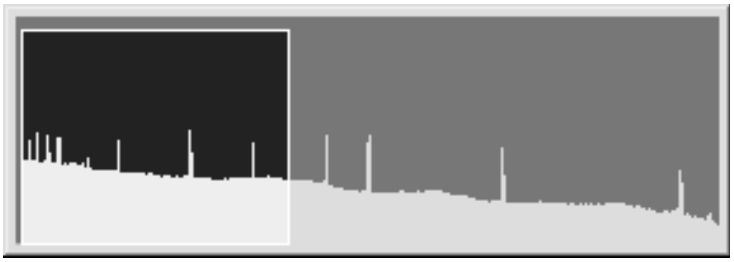


Fig. 8. Contents of Expanded Spectrum View are Highlighted in Full Spectrum View.

7. The **Expanded Spectrum View** shows all or part of the full histogram; this allows you to zoom in on a particular part of the spectrum and see it in more detail. You can change the expanded view vertical and horizontal scaling, and perform a number of analytical operations such as peak information, marking ROIs, or calibrating the spectrum. This window contains a vertical line called a *marker* that highlights a particular position in the spectrum. Information about that position is displayed on the Marker Information Line (see item 10 below).

8. **ROI Status Area**, on the right side of the menu bar, indicates whether the ROI marking mode is currently **Mark** or **UnMark**. This operates in conjunction with the **ROI** menu commands and arrow keys (see Section 4.5).

9. **Status Sidebar**, on the right side of the screen, provides information on the current Detector presets and counting times, the time and date, and a set of buttons for moving easily between peaks, ROIs, and library entries (see Section 3.6).

10. **Marker Information Line**, beneath the spectrum, showing the marker channel, marker energy, and channel contents.

11. **Supplementary Information Line**, below the Marker Information Line, used to show library contents, the results of certain calculations, warning messages, or instructions.

3.3. Spectrum Displays

The Full and Expanded Spectrum Views show, respectively, a complete histogram of the current spectrum (whether from a Detector or the buffer) and an expanded view of all or part of the spectrum. These two windows are the central features of the MAESTRO screen. All other windows and most functions relate to the spectrum windows. The Full Spectrum View shows the entire data memory of the Detector as defined in the configuration. In addition, it has a marker box showing which portion of the spectrum is displayed in the Expanded Spectrum View.

The Expanded Spectrum View contains a reverse-color marker line at the horizontal position of the pixel representing the marker channel. This marker can be moved with the mouse pointer, as described in Section 3.5.1, and with the **<←>/<→>** and **<PgUp>/<PgDn>** keys.

Note that in both spectrum windows the actual spectrum is scaled to fit in its window as it appears on the display. Also, since both windows can be arbitrarily resized (a feature of Windows), it follows that the scaling is not always by powers of two, nor even integral multiples. Therefore, MAESTRO uses algorithms to scale the window properly and maintain the correct peak shapes regardless of the actual size of the window. The vertical scale in the Full Spectrum View is always logarithmic. In the Expanded Spectrum View, use the menus, right-mouse-button menu, accelerator keys, and Toolbar to choose between logarithmic and linear scales, change both axis scales by zooming in and out, and select which region of the spectrum to view.

The spectrum display can be expanded to show more detail or contracted to show more data using the **Zoom In** and **Zoom Out** features.[2] Zooming in and out can be performed using the Toolbar buttons, the **Display** menu commands, or the *rubber rectangle* (see Section 3.5.3). The rubber rectangle allows the spectrum to be expanded to any horizontal or vertical scale. The baseline or "zero level" at the bottom of the display can also be offset with this tool, allowing the greatest possible flexibility in showing the spectrum in any detail.

[2]These replace the **Narrower/Wider** and **Shorter/Taller** commands in older versions of MAESTRO.

The Toolbar and **Display** menu zoom commands offer a quick way to change the display. These change both the horizontal and vertical scales at the same time. **Zoom In** decreases the horizontal width by about 6% of full width (ADC conversion gain) and halves the vertical scale. The **Zoom In** button and menu item zoom to a minimum horizontal scale of 6% of the ADC conversion gain. **Zoom Out** increases the horizontal width by about 6% of full width (ADC conversion gain) and doubles the vertical scale.

The accelerator keys have also changed. **Keypad<+>** and **Keypad<–>**, respectively, duplicate the **Zoom In** and **Zoom Out** Toolbar buttons and **Display** menu commands. The **<F5>/<F6>** and <↓>/<↑> keys change the vertical scale by a factor of two without changing the horizontal scale. The **<F7>/<F8>** and ***keyboard*** <–>/<+> keys change the horizontal scale by a factor of two without changing the vertical scale.

Depending on the expansion or overall size of the spectrum, all or part of the selected spectrum can be shown in the expanded view. Therefore, the number of channels might be larger than the horizontal size of the window, as measured in pixels. In this case, where the number of channels shown exceeds the window size, all of the channels cannot be represented by exactly one pixel dot. Instead, the channels are grouped together, and the vertical displacement corresponding to the maximum channel in each group is displayed. This maintains a meaningful representation of the relative peak heights in the spectrum. For a more precise representation of the peak shapes displaying all available data (i.e., where each pixel corresponds to exactly one channel), the scale should be expanded until the number of channels is less than or equal to the size of the window.

Note that the marker can be moved by no less than one pixel or one channel (whichever is greater) at a time. In the scenario described above, where there are many more memory channels being represented on the display than there are pixels horizontally in the window, the marker will move by more than one memory channel at a time, even with the smallest possible change as performed with the <→> and <←> keys. If true single-channel motions are required, the display must be expanded as described above.

In addition to changing the scaling of the spectrum, the colors of the various spectrum features (e.g., background, spectrum, ROIs) can be changed using the **Display** menu.

3.4. The Toolbar

The row of buttons below the Menu Bar provides convenient shortcuts to some of the most common MAESTRO menu functions.

The **Recall** button retrieves an existing spectrum file. This is the equivalent of selecting **File/Recall** from the menu.

Save copies the currently displayed spectrum to disk. It duplicates the menu functions **File/Save** or **File/Save As...** (depending on whether the spectrum was recalled from disk, and whether any changes have been made to the spectrum window since the last save).

Start Acquisition starts data collection in the current Detector. This duplicates **Acquire/Start** and **<Alt + 1>**.

Stop Acquisition stops data collection. This duplicates **Acquire/Stop** and **<Alt + 2>**.

Clear Spectrum clears the detector or file spectrum from the window. This duplicates **Acquire/Clear** and **<Alt + 3>**.

Mark ROI automatically marks an ROI in the spectrum at the marker position, according to the criteria in Section 4.5.4. This duplicates **ROI/Mark Peak** and **<Insert>**.

Clear ROI removes the ROI mark from the channels of the peak currently selected with the marker. This duplicates **ROI/Clear** and **<Delete>**.

The next section of the Toolbar (Fig. 9) contains the buttons that control the spectrum's vertical scale. These commands are also on the **Display** menu. In addition, vertical scale can be adjusted by zooming in with the mouse (see Fig. 15).

Fig. 9. Vertical Scaling Section of Toolbar.

Vertical Log/Lin Scale switches between logarithmic and linear scaling. When switching from logarithmic to linear, it uses the previous linear scale setting. Its keyboard duplicate is **Keypad</>**.

Vertical Auto Scale turns on the *autoscale* mode, a linear scale that automatically adjusts until the largest peak shown is at its maximum height without overflowing the display. Its keyboard duplicate is **Keypad<*>**.

The field to the left of these two buttons displays **LOG** if the scale is logarithmic, or indicates the current vertical full-scale linear value.

The horizontal scaling section (Fig. 10) follows next. It includes a field that shows the current window width in channels, and the **Zoom In**, **Zoom Out**, **Center,** and **Baseline Zoom** buttons. These commands are also on the **Display** menu. In addition, horizontal scale can be adjusted by zooming in with the mouse (see Fig. 15).

Fig. 10. Horizontal Scaling Section of Toolbar.

Zoom In decreases the horizontal full scale of the Expanded Spectrum View according to the discussion in Section 3.3, so the peaks appear "magnified." This duplicates **Display/Zoom In** and **Keypad<+>**.

Zoom Out increases the horizontal full scale of the Expanded Spectrum View according to the discussion in Section 3.3, so the peaks appear reduced in size. This duplicates **Display/Zoom Out** and **Keypad<–>**.

Center moves the marker to the center of the screen by shifting the spectrum without moving the marker from its current channel. This duplicates **Display/Center** and **Keypad<5>**.

Baseline Zoom keeps the baseline of the spectrum set to zero counts.

The right-most part of the Toolbar is a drop-down list of the available Detectors (Fig. 11). To select a Detector or the buffer, click in the field or on the down-arrow beside it to open the list, then click on the desired entry. The sidebar will register your selection.

Finally, note that as you pause the mouse pointer over the center of a Toolbar button, a pop-up *tool tip* box opens, describing the button's function (Fig. 12).

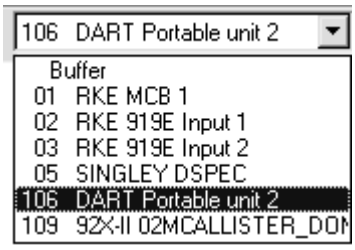


Fig. 11. Drop-Down Detector List.

Fig. 12. Tool Tip.

3.5. Using the Mouse

The mouse can be used to access the menus, Toolbar, and sidebars; adjust spectrum scaling; mark and unmark peaks and ROIs; select Detectors; work in the dialogs — every function in MAESTRO except text entry. For most people, this might be more efficient than using the keyboard. The following sections describe specialized mouse functions.

3.5.1. Moving the Marker with the Mouse

To position the marker with the mouse, move the pointer to the desired channel in the Expanded Spectrum View and click the left mouse button once. This will move the marker to the mouse position. This is generally a much easier way to move the marker around in the spectrum than using the arrow keys, although you might prefer to use the keys for specific motions (such as moving the marker 1 channel at a time).

3.5.2. The Right-Mouse-Button Menu

Figure 13 shows the right-mouse-button menu. To open it, position the mouse pointer in the spectrum display, click the right mouse button, then use the left mouse button to select from its list of commands. Not all of the commands are available at all times, depending on the spectrum displayed and whether the rubber rectangle is active. Except for **Undo Zoom In**, all of these func-tions are on the Toolbar and/or the Menu Bar (**Peak Info** and **Sum** are only on the Menu Bar, under **Calculate**). See Section 4.8 for more information on the commands.

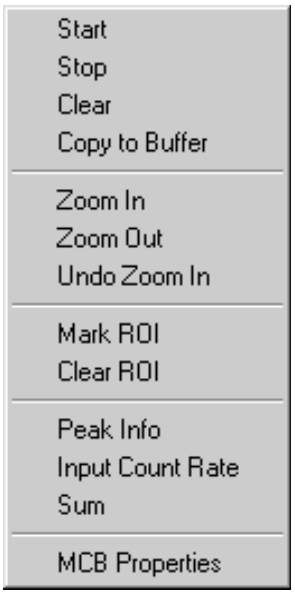


Fig. 13. Right-Mouse-Button Menu for Spectra.

3.5.3. Using the "Rubber Rectangle"

The *rubber rectangle* is used for selecting a particular area of interest within a spectrum. It can be used in conjunction with the right-mouse-button menu in Fig. 13 for many functions. To draw a rubber rectangle:

1. Click and hold the left mouse button; this anchors the starting corner of the rectangle.

2. Drag the mouse diagonally across the area of interest. As you do this, the mouse will be drawing a reverse-color rectangle bisected by the marker line. Note that when drawing a rubber rectangle, the marker line combines with a horizontal line inside the rectangle to form crosshairs (Fig. 14). They make it easy to select the center channel in the area of interest — this might be the center of an ROI that you wish to mark or unmark, a portion of the spectrum to be summed, or a peak for which you want detailed information.

3. Release the mouse button; this anchors the ending corner of the rectangle.

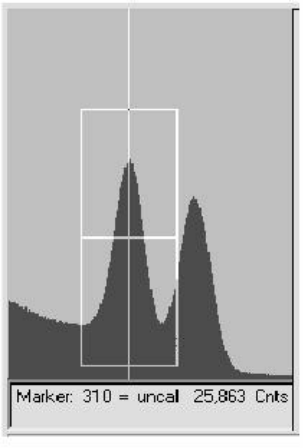


Fig. 14. The Rubber Rectangle's Crosshairs.

4. Click the right mouse button to open its menu, and select one of the available commands. Once an area is selected, the commands can also be issued from the Toolbar, Menu Bar, Status Sidebar, or keyboard.

As an example, Fig. 15 illustrates the process of marking a region with a rubber rectangle and zooming in using the right-mouse-button menu.

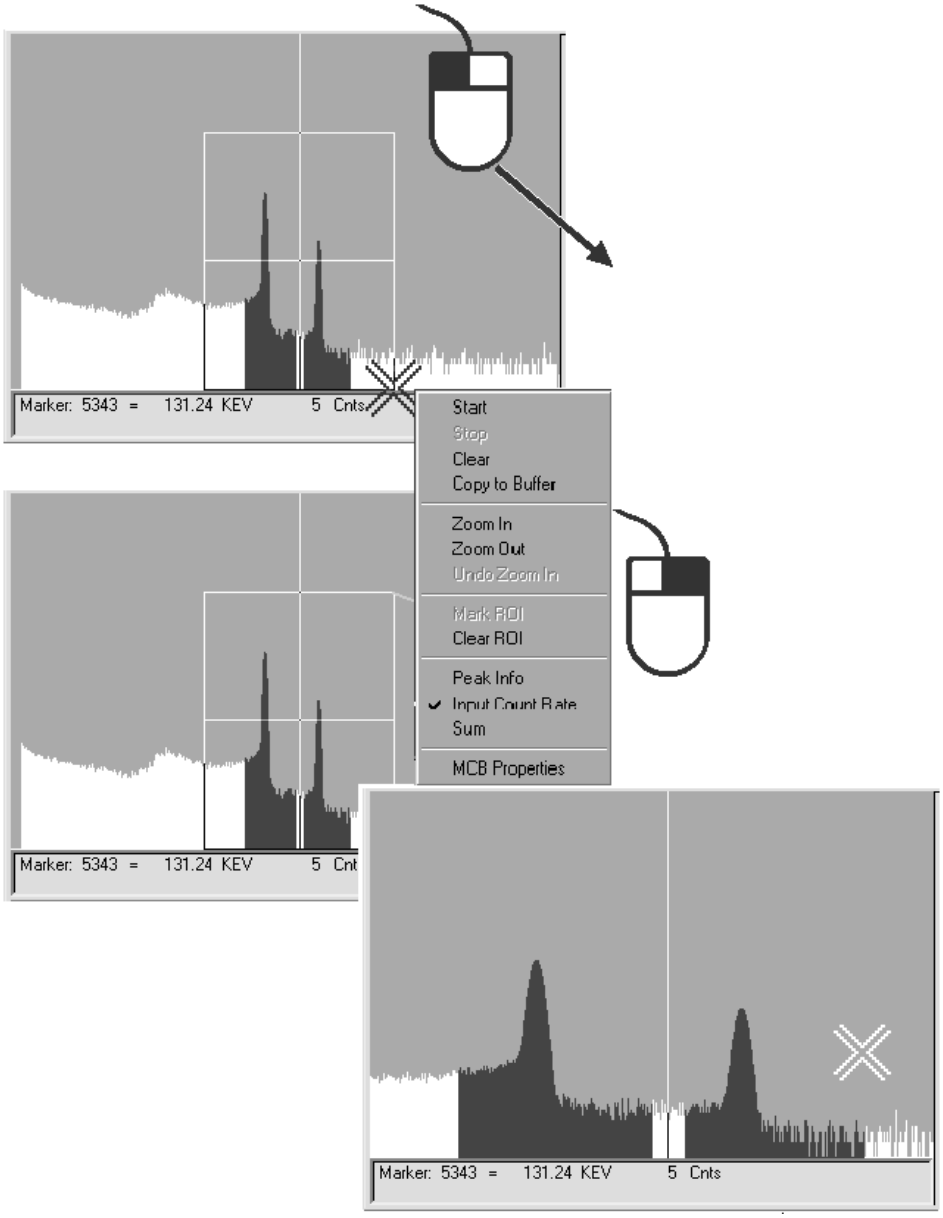


Fig. 15. Zooming In Using the Rubber Rectangle and Right-Mouse-Button Menu.

3.5.4. Sizing and Moving the Full Spectrum View

To change the horizontal and vertical size of the Full Spectrum View, move the mouse pointer onto the side edge, bottom edge, or corner of the window until the pointer changes to a double-sided arrow (see Fig. 16). Click and hold the left mouse button, drag the edge of the window until it is the size you want, then release the mouse button.

To move the Full Spectrum View to a different part of the screen, move the mouse pointer onto the top edge of the window until the pointer changes to a four-sided arrow (see Fig. 16). Click and hold the left mouse button, drag the window to its new location, and release the mouse button.

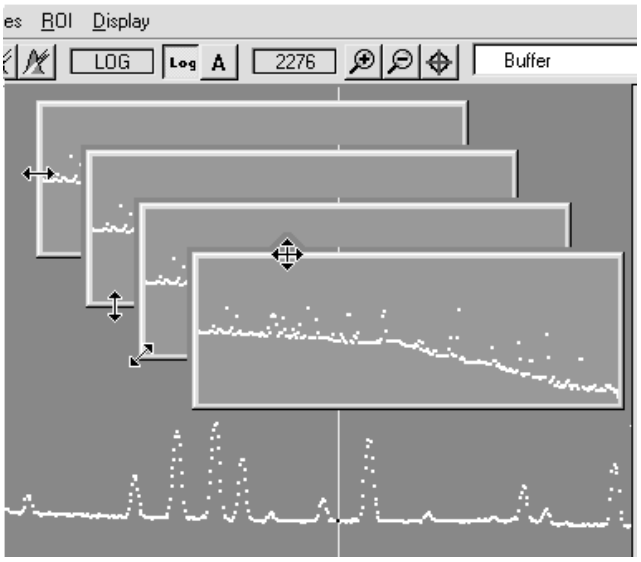


Fig. 16. Two-Sided Pointer for Sizing Full Spectrum View, and Four-Sided Pointer for Moving Window.

3.6. Buttons and Boxes

This section describes MAESTRO's radio buttons, indexing buttons, and checkboxes. To activate a button or box, just click on it.

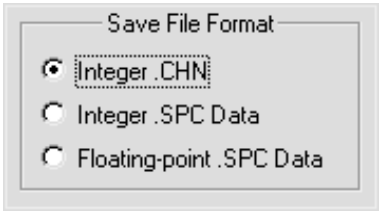


Fig. 17. Radio Buttons.

Radio buttons (Fig. 17) appear on many MAESTRO dialogs, and allow only one of the choices to be selected.

Checkboxes (Fig. 18) are another common feature, allowing one or more of the options to be selected at the same time.

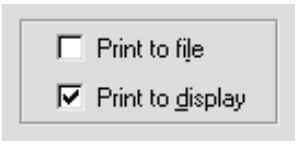
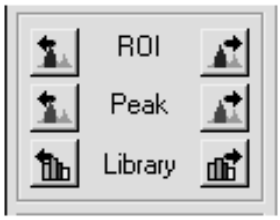


Fig. 18. Checkboxes.

The **ROI**, **Peak**, and **Library** indexing buttons on the Status Sidebar are useful for rapidly locating ROIs or peaks, and for advancing between entries in the library. When the last item in either direction is reached, the computer beeps and MAESTRO posts a "no more" message on the Supplementary Information Line. If a library file has not been loaded or the Detector is not calibrated, the **Library** buttons are disabled and shown in gray.

The indexing buttons are displayed in two different ways, depending on whether MAESTRO is in Detector or buffer mode. This is shown in Fig. 19.

In Detector mode, the buttons appear at the bottom of the Status Sidebar. In buffer mode, the buttons are overlaid where the **Presets** and indexing buttons are displayed in Detector mode.



The **ROI**, **Peak**, and **Library** buttons function the same in both modes. In buffer mode, the additional features are the ability to insert or delete an ROI with the **Ins** and **Del** buttons, respectively (located between the **ROI** indexing buttons); and to display the peak information for an ROI with the **Info** button (located between the **Peak** indexing arrows).

Fig. 19. Indexing Buttons (Detector mode, top; buffer mode, bottom).

The **Library** buttons are useful after a peak has been located to advance forward or backward through the library to the next closest library entry. Each button press advances to the next library entry and moves the marker to the corresponding energy.

Instead of using the **Peak** buttons to index from a previously identified peak, position the marker anywhere in the spectrum and click on the **Library** buttons to locate the entries closest in energy to that point. If a warning beep sounds, it means that all library entries have been exhausted in that direction, or that the spectrum is not calibrated. In any case, if an appropriate peak is available at the location of the marker, data on the peak are displayed on the Marker Information Line at the bottom of the screen.

The **ROI** and **Peak** indexing buttons are duplicated by **<Shift+ ←>**/ **<Shift+ →>** and **<Ctrl+ ←>**/ **<Ctrl+ →>**, respectively. The **Library** buttons are duplicated by **<Alt+ ←>**/**<Alt+ →>**. The **Del** button function is duplicated by the **<Delete>** key and **Clear ROI** on the menus and Toolbar. The **Ins** button has the same function as the **<Insert>** key and **Mark ROI** on the menus and Toolbar. The **Info** button duplicates the **Calculate/Peak Info** command, **Peak Info** on the right-mouse-button menu, and double-clicking in the ROI.

3.7. Opening Files with Drag and Drop

Several types of files can be selected and loaded into MAESTRO using the Windows *drag-and-drop* feature. The file types are: spectra (**`.SPC`**, **`.AN1`**, **`.CHN`**), library (**`.LIB`**), and region of interest (**`.ROI`**).

The drag-and-drop file is handled the same as a read (recall) operation for that type of file. For spectra, this means a buffer window is opened, the file is loaded into it, and the spectrum is displayed. Library files become the working library files. The ROIs saved in an **`.ROI`** file are read and the regions set.

To drag and drop, open MAESTRO and Windows Explorer, and display both together on the screen. Locate a file in Explorer such as **DEMO.CHN**. Now click and hold the left mouse button, move the mouse (along with the file "ghost") to the MAESTRO window, and release the mouse button. The spectrum file will open as if you had recalled it from within MAESTRO.

3.8. Associated Files

When MAESTRO is installed, it registers the spectrum files in Windows so they can be opened from Windows Explorer by double-clicking on the filename. The spectrum files are displayed in WINPLOTS. These files are marked with a spectrum icon ( ) in the Explorer display. The **.JOB** files ( ) are also registered, and open in Windows Notepad.

3.9. Editing

Many of the text entry fields in the MAESTRO dialogs support the Windows editing functions on the right-mouse-button menu. Use these functions to copy text from field to field with ease, as well as from program to program. Position the mouse pointer in the text field and click the right mouse button to open the menu shown in Fig. 20. Select a function from the menu with the left mouse button.

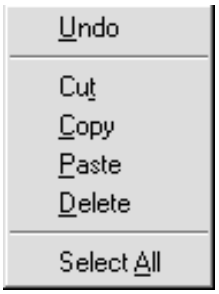


Fig. 20. Right-Mouse-Button Menu for Dialogs.

4. MENU COMMANDS

This chapter describes the MAESTRO-32 menu commands and their associated dialogs. As is customary for Windows menus, the accelerator(s) (if any) are shown to the right of the menu function they duplicate. Also, the underlined letter in the menu item indicates a key that can be used together with the **<Alt>** key for quick access in the menu. (So, for example, the **Compare...** dialog under **File** can be reached with the key sequence **<Alt + F>**, **<Alt + C>**.) The ellipsis (**...**) following a menu selection indicates that a dialog is displayed to complete the function. Finally, a small arrow ("▸") following a menu selection means a submenu with more selections will be shown. The menus and commands covered in this chapter, in the order they appear on the menu bar, are:

File (page 27)

- Settings...
- Recall...
- Save
- Save As...
- Export...
- Import...
- Print...
- ROI Report...
- Compare...
- Exit
- About MAESTRO...

Acquire (page 42)

Start	Alt+1
Stop	Alt+2
Clear	Alt+3
Copy to Buffer	Alt+5
Download Spectra	
View ZDT Corrected	F3
MCB Properties...	

Calculate (page 84)

- Settings...
- Calibration...
- Peak Search
- Peak Info
- Input Count Rate
- Sum
- Smooth
- Strip...

Services (page 91)

- JOB Control...
- Library file ▸
  - Select Peak
  - Select File
- Sample Description...
- Lock/Unlock Detector...
- Edit Detector list...

ROI (page 96)

Off	F2 or Alt+O
Mark	F2 or Alt+M
UnMark	F2 or Alt+U
Mark Peak	Insert
Clear	Delete
Clear All	
Save File...	
Recall File...	

Display (page 99)

Detector...	Ctrl+<Fn>
Detector/Buffer	F4 or Alt+6
Logarithmic	Keypad(/)
Automatic	Keypad(*)
Baseline Zoom	
Zoom In	Keypad(+)
Zoom Out	Keypad(-)
Center	Keypad(5)
Full View	
Isotope Markers	
Preferences ▸	

- Points
- Fill ROI
- Fill All
- Spectrum Colors...
- Peak Info Font/Color...

Window (page 104)

Cascade
Tile Horizontally
Tile Vertically
Arrange Icons
Auto Arrange
Multiple Windows
[List of open Detector and buffer windows]

Right-Mouse-Button Menu (page 105)

Start
Stop
Clear
Copy to Buffer
Zoom In
Zoom Out
Undo Zoom In
Mark ROI
Clear ROI
Peak Info
Input Count Rate
Sum
MCB Properties

4.1. File

The **File** menu is shown in Fig. 21. If MAESTRO is in Detector mode and the selected Detector is acquiring data, the **Compare...** command is disabled (gray).

Fig. 21. File Menu.

4.1.1. Settings...

The **File Settings** dialog allows you to specify how the spectrum data are saved, exported, and imported; and to set the directories for file types used by MAESTRO.

4.1.1.1. General

The entries on this tab (Fig. 22) control the default spectrum file format and sample description to be saved with the spectrum. You can also activate the ask-on-save feature for the sample description so it can be modified before the spectrum is saved.

When you finish setting the parameters in this dialog and click on **OK**, these settings will be used until changed.

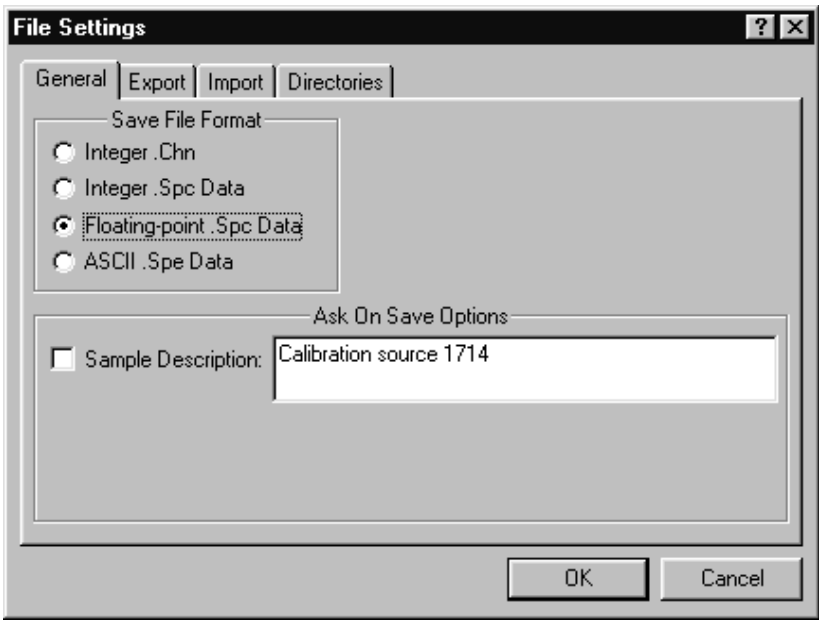


Fig. 22. General Tab.

The file types are integer **.CHN**, integer **.SPC** floating-point **.SPC**, and ASCII **.SPE**. The **.CHN** file format is the format used by all versions of MAESTRO. It is the simplest format and, therefore, the easiest to read with other programs. It does not contain the analysis parameter data, the complete calibration, or other data needed for the nuclide analysis. The format is described in the *ORTEC Software File Structure Manual for DOS and Windows® Systems* (Part No. 753800, hereinafter called the "File Structure Manual").

The two **.SPC** formats, integer and floating-point, are identical except for the format of the spectrum data. The integer **.SPC** format should be used unless the files are to be used by earlier versions of ORTEC programs. The **.SPC** files written by MAESTRO contain the energy calibration data and the hardware parameters. The integer format stores the spectrum as 4-byte integers and the floating-point format uses the 4-byte exponential format used in the hardware math coprocessor (e.g., 80387) and most languages for the PC. The analysis and calibration formats are defined in the File Structure Manual.

Sample Description allows you to designate the default sample description to be saved with the spectrum (128-character maximum for **.SPC** files; 63 characters for **.CHN** files). If you also mark the corresponding **Ask on Save** checkbox, this description will be presented for acceptance or modification when the spectrum is saved. This is a time-saver that lets you enter the common descriptors for a group of samples ahead of time then add the unique descriptors on a sample-by-sample basis after acquisition.

4.1.1.2. Export

Click on the **Export** tab to display the screen shown in Fig. 23. The program, arguments, and file directory to be used when the **Export** function is selected are specified here.

Choose any program[3] that can accept the spectrum filename as an argument on the command line. Use the **Browse...** button to automatically select the complete proper path for the program.

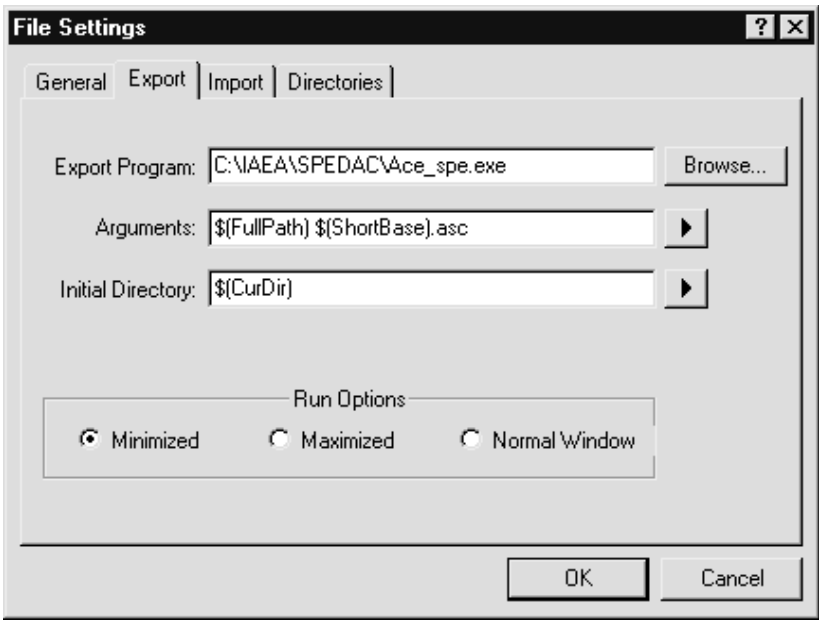


Fig. 23. Export Tab.

Arguments

The **Arguments** to the program can be specified as directly entered character strings or you can select from the list of "macros" shown in Fig. 24. The list is displayed by clicking on the arrow button to the right of the **Arguments** field. Entries (macros or direct) must be separated by spaces to be read as separate arguments.

File Path Name

This will insert the complete file pathname (e.g., **`c:\user\spectrum\test.chn`**) into the dialog box. The filename is the name selected in the filename entry dialog.

File Base Name

This will insert the file path name *without* the extension (e.g., **`c:\user\spectrum\test`**) into the dialog box. The filename is the name selected in the filename entry dialog. The extension can be entered manually after the macro (e.g., **`$(FullBase).CHN`**) into the dialog box. *Note that the "dot" (.) must also be entered*. Related filenames can also be made by adding characters before the "dot" (e.g., **`$(FullBase)A.CHN`**).

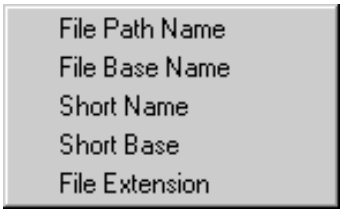


Fig. 24. Export Argument Macros.

Short Name

This will insert the filename (e.g., **`test.CHN`**) into the dialog box. The filename is the name selected in the filename entry dialog. File names can be constructed as **`$(file base).$(file extension)`**.

[3]Any executable program that can be executed from the Windows **Run** command can be selected, including DOS batch commands.

Short Base

This will insert the base filename (e.g., **`test`**) into the dialog box. The file base name is the name selected in the filename entry dialog.

File Extension

This will insert the file extension (e.g., **`CHN`**) into the dialog box. The file extension is the name selected in the filename entry dialog. *Note that the "dot" is not included*. Any manually inserted input of the macro form (**`$(xxx)`**) will be included in the argument list without changes.

Initial Directory

The initial directory for the program to use can be specified as directly entered character strings or the user can select from the list of macros in Fig. 25. The list is displayed by clicking on the arrow button to the right of the **Initial Directory** field.

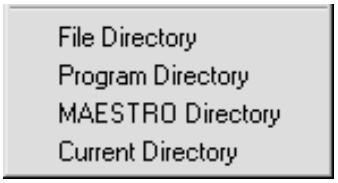


Fig. 25. The Initial Character Macros.

File Directory

This is the directory selected in the filename selection dialog when the export file is selected (e.g., **`c:\user\spectrum\`**).

Program Directory

This is the directory for the conversion program. It is shown in the first entry of this dialog.

MAESTRO Directory

This is the directory where the MAESTRO program is stored. By default, this is **`c:\Program Files\MAESTRO`**.

Current Directory

This is the current default directory for Windows.

Run Options

These three radio buttons (**Minimized**, **Maximized**, and **Normal Window**) are used to select the window for the program. If the program does not have any user dialogs, any option can be selected. If the program needs user inputs, **Normal Window** should be selected.

4.1.1.3. Import

Click on the **Import** tab to display the dialog shown in Fig. 26. The program to be executed and the default file extension when the Import function is selected can then be specified. You can select any program that can accept the spectrum filename on the command line. Use the **Browse...** button to automatically select the complete proper path for the program.

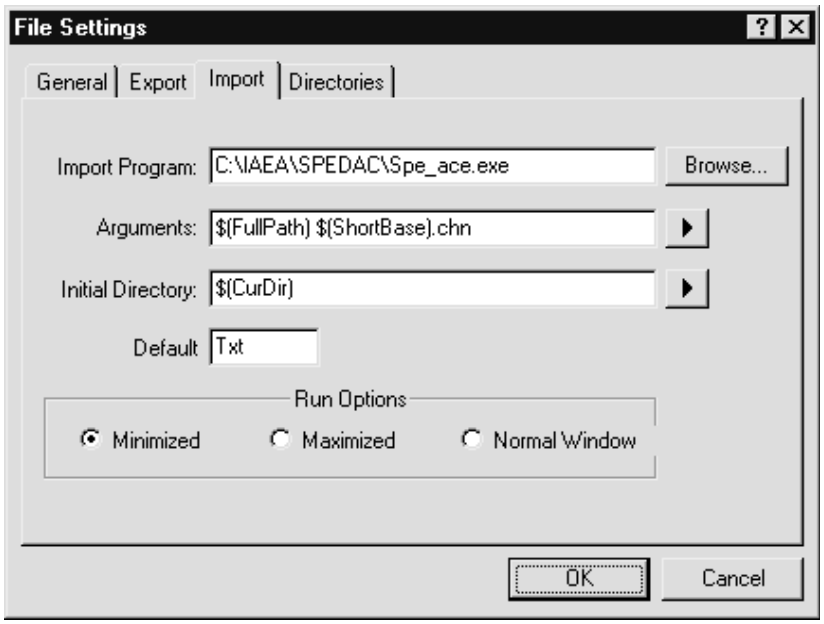


Fig. 26. Import Tab.

Arguments

The arguments to the program can be specified as directly entered character strings or you can select from the list of macros shown in Fig. 27. The list is displayed by clicking on the arrow button to the right of the **Arguments** field. The entries (macros or direct) must be separated by spaces to be read as separate arguments.

File Path Name

This will insert the *complete* file path name (e.g., **`c:\user\spectrum\test.txt`**) into the dialog box. The filename is the name selected in the filename entry dialog.

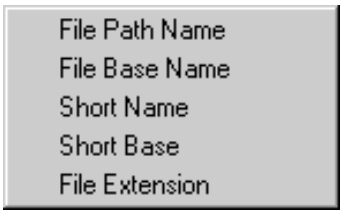


Fig. 27. Import Arguments.

File Base Name

This will insert the file path name *without* the extension (e.g., **`c:\user\spectrum\test`**) into the dialog box. The filename is the name selected in the file name entry dialog. The extension can be entered manually after the macro (e.g., **`$(FullBase).CHN`**) into the dialog box. *Note that the "dot" (.) must also be entered*. Related filenames can also be made by adding characters before the "dot" (e.g., **`$(FullBase)A.CHN`**).

Short Name

This will insert the filename (e.g., **`test.TXT`**) into the dialog box. The filename is the name selected in the filename entry dialog. File names can be constructed as **`$(file base).$(file extension)`**.

Short Base

This will insert the base filename (e.g., **`test`**) into the dialog box. The file base name is the name selected in the filename entry dialog.

File Extension

This will insert the file extension (e.g., **`TXT`**) into the dialog box. The file extension is the name selected in the filename entry dialog. *Note that the "dot" is not included*. Any manually entered input of the macro form (**`$(xxx)`**) will be included in the argument list without changes.

Initial Directory

Specify the initial directory for the program to use either with directly entered character strings or by selecting from the list of macros shown in Fig. 28. The list is displayed by clicking on the arrow button to the right of the **Initial Directory** field.

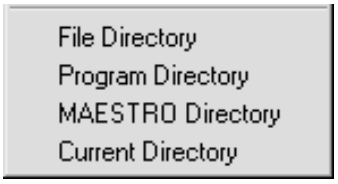


Fig. 28. Import Macros.

File Directory

This is the directory selected in the filename selection dialog when the import file is selected (e.g., **`c:\user\spectrum\`**).

Program Directory

This is the directory for the conversion program. It is shown in the first entry of this dialog.

MAESTRO Directory

This is the directory where the MAESTRO program is stored. Usually this is **`c:\Program Files\MAESTRO`**.

Current Directory

This is the current default directory for Windows.

Default

The default extension entered here is used as the extension for the filename in the filename entry dialog. For example, if you enter **`TXT`**, the name list in the entry dialog will be **`*.TXT`**.

Run Options

These three radio buttons (**Minimized**, **Maximized**, and **Normal Window**) are used to select the window for the program. If the program does not have any user dialogs, any option can be selected. If the program needs user inputs, **Normal Window** should be selected.

4.1.1.4. Directories

Use this tab (Fig. 29) to select the default file directories for libraries, calibrations, `.JOB` files, and other GammaVision file types.

To change the path (**Location**) of a particular **File Type**, click on the desired file type to highlight it, then click on **Modify...**. This will open a standard file-recall dialog. Choose a new path and click on **Open**. When all path changes have been completed, click on **OK** to use them or **Cancel** to retain the previous settings.

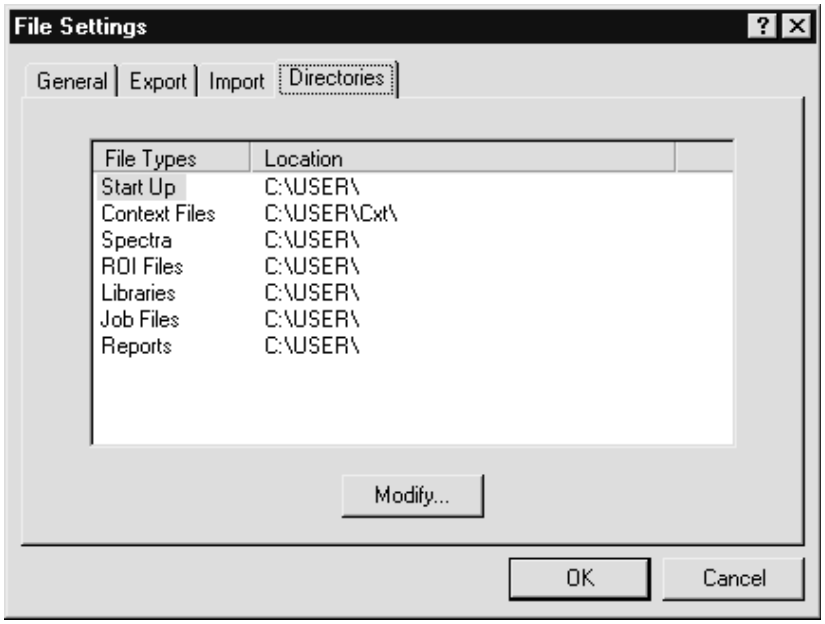


Fig. 29. Directories Tab.

4.1.2. Recall...

This function reads an ORTEC `.CHN` or `.SPC` spectrum file into a new buffer window. It opens a standard Windows file-open dialog (Fig. 30), allowing you to select the file to be recalled.

Note the **Show Description** checkbox on the lower left of the Recall Spectrum File dialog. Use this to display the sample description, format, and spectrum size of each file without having to open it.

If the maximum eight buffer windows are currently open, MAESTRO will ask if you wish to close the oldest buffer. Answering **No** will cancel the recall operation and the oldest buffer will remain onscreen. Answering **Yes** will close the oldest buffer and open a new buffer containing the recalled file. If the oldest buffer contains data that have not been saved, a warning dialog will first ask if the data should be saved. Click on **Yes** to save and **No** to close without saving.

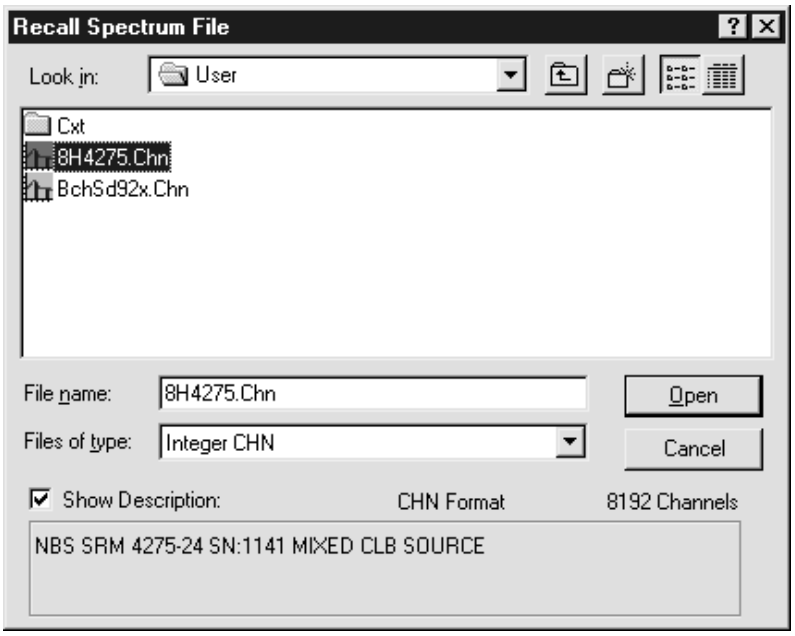


Fig. 30. Recall Spectrum Dialog.

When the spectrum is successfully recalled, MAESTRO loads its descriptors (e.g., start time, live time, real time, Detector and sample description) and displays the filename on the Title Bar. If the spectrum file has calibration information, it is used to set the calibration for this buffer.

4.1.3. Save and Save As...

These functions save the current spectrum to disk. The Save Spectrum File dialog (Fig. 31) opens when **Save As...** is selected, when **Save** is selected for a spectrum that has no previous filename associated with it, or after any operation is performed that can alter the spectrum.

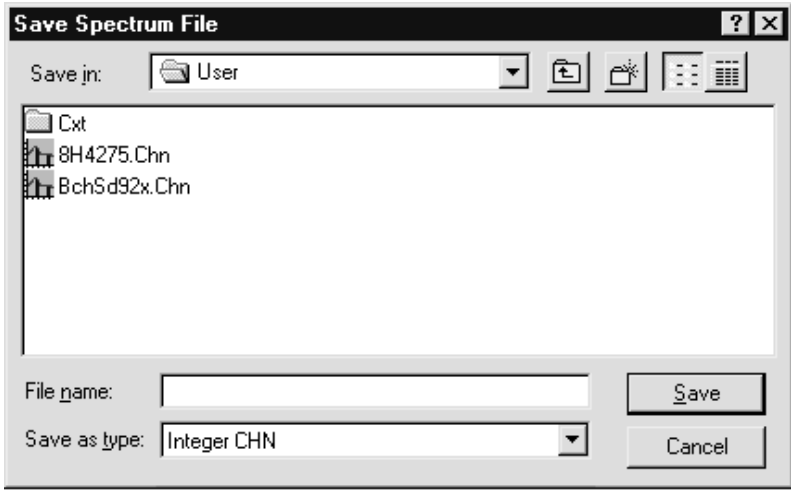


Fig. 31. Save Spectrum File Dialog.

Enter any valid filename (consisting of an optional drive and directory, a filename, and an optional extension) in the **File name** field and click on **Save**. The recommended and default extension are shown in the dialog according to the format chosen. If that file already exists, a message box will open asking you to verify the entry or cancel the operation. Clicking on **OK** will completely overwrite the existing file.

After the disk file has been written, its filename will be displayed on the Title Bar.

The format is specified on the General tab under **File/Settings...** (Section 4.1.1.1), so the file extension should be left at the default setting to avoid operator confusion. This is especially true if the spectra are to be used in non-ORTEC programs.

The `.CHN` file format stores the following information along with the spectrum: live time, real time, acquisition start time, Detector and sample descriptions, and calibration (if any). The file structure of all the files is given in the File Structure Manual.

Much more information can be saved in the `.SPC` format, which is used primarily in GammaVision. MAESTRO does not have the ability to generate all of this information, so certain parts are not filled. However, MAESTRO does have the ability to generate ROI records and a list of hardware parameters.

4.1.4. Export...

The **Export...** function is used to write spectra in formats other than the usual formats, or to perform other functions such as plotting or printing the spectrum directly. The export program is specified on the Export tab under **File/Settings...**, as discussed in Section 4.1.1.2. The program can be one of the programs supplied or can be user-supplied. When **Export...** is selected, the Export Spectrum File dialog (Fig. 32) opens. Choose the filename of the spectrum to be exported and click on **Open**.

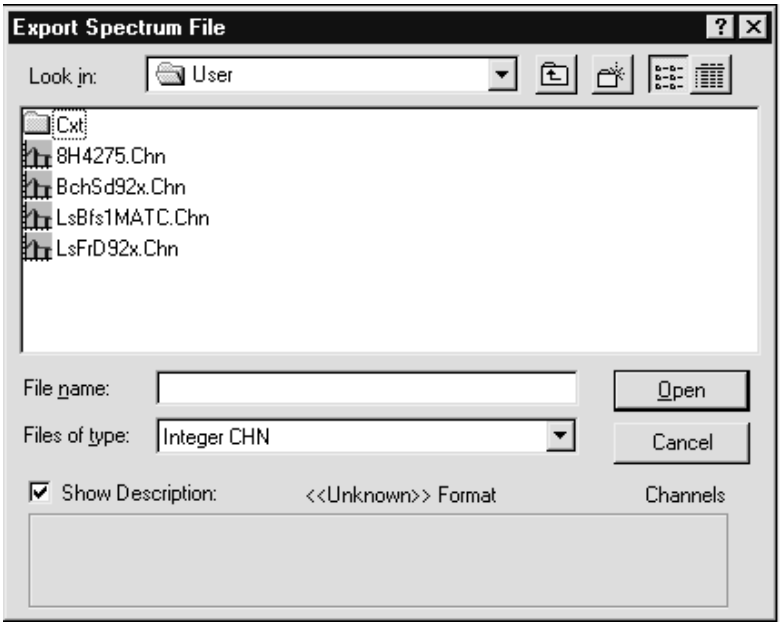


Fig. 32. The Export Spectrum File Dialog.

The currently displayed spectrum must be saved to disk before it can be exported. If the currently displayed spectrum has already been stored to disk, that filename is the default. Any file can be selected. The file is then read and the output file is written by the program.

The **Export...** function is not available for a second file until the first file has been exported and the export program has stopped execution.

Export... can also be used to generate hardcopy plots. To do this, select the WINPLOTS program (supplied with MAESTRO) as the export program. When **Export...** has been selected, the WINPLOTS program will be executed. If the `-P` switch is specified on the command line (see Sections 4.1.1.2 and 7.1.3), the program will plot the spectrum and exit automatically.

4.1.5. Import...

The **Import** function is used to read spectrum files that are not in one of the usual formats (i.e., **.CHN** or **.SPC**). The import program is specified on the Import tab under **File/Settings...**, as discussed in Section 4.1.1.3. The program can be one of the programs supplied or can be user-supplied. When selected, the **Import File** dialog (see Fig. 33) opens so that you can select the filename. The file is then read and a spectrum file is written to the specified directory. MAESTRO attempts to read this file (in **.CHN** or **.SPC** format) and displays the spectrum in the buffer.

Fig. 33. The Import File Dialog.

If the import program does not produce a file that MAESTRO can read, the buffer is not changed.

4.1.6. Print...

The **Print...** function does one of the following:

- If the marker is in an ROI, the data contents of the ROI channels are printed.
- If the marker is not in an ROI, the contents of channels in the expanded view are printed.

Use the **Print** dialog (Fig. 34) to print the output or save it in a disk file (click on **Print to file** to mark it). An abort box appears while the function is being performed, allowing you to cancel the operation. The printer can be selected or its properties changed via a standard Windows printer setup dialog.

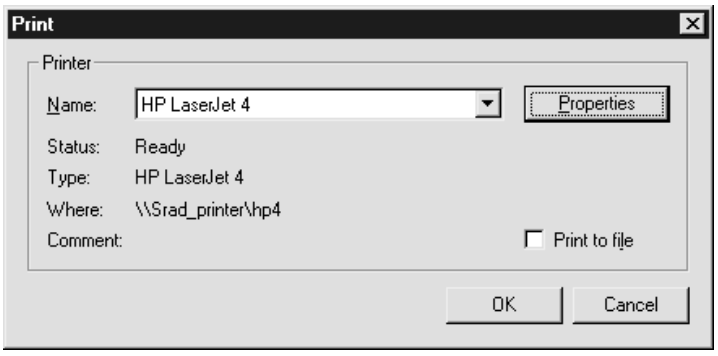


Fig. 34. Print Spectrum.

The data are formatted at seven channels per line with the channel number on the left.

4.1.7. ROI Report...

The **ROI Report...** function creates a report describing acquisition conditions and contents of all ROIs, and sends the complete report to the printer (the default choice) and/or to a disk file (**Print to file**). In addition, you can select **Print to display** to show on-screen a similar report *only for the ROIs currently displayed in the Expanded Spectrum View.*

The **ROI Report** dialog, shown in Fig. 35, opens first. It allows you to select a file, preview it on-screen or send the report to the printer (via Windows), and select one of two output formats, **Paragraph** or **Column**.

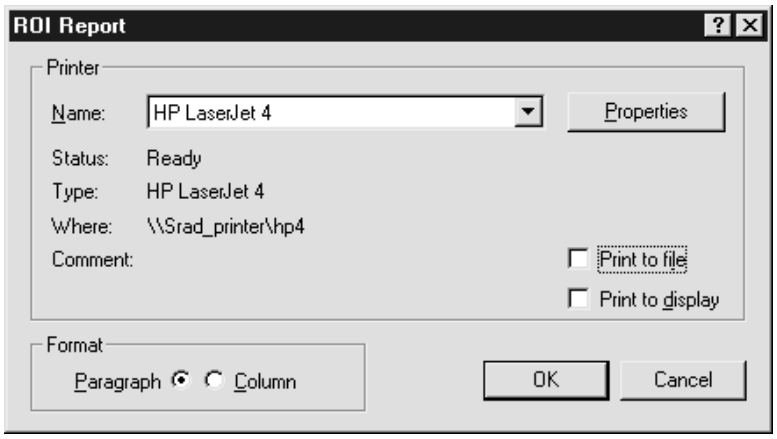


Fig. 35. ROI Report Dialog.

Both report formats supply the same information. If the spectrum is not calibrated, the following are reported for each ROI:

1. ROI number and Detector number.
2. Start channel of the ROI.
3. Stop channel of the ROI.
4. Gross area of the peak.
5. Net area of the peak, as calculated in **Calculate/Peak Info**.
6. Error in net area, as calculated in **Calculate/Peak Info**.
7. Centroid channel of peak, as calculated in **Calculate/Peak Info**.
8. Full width at half maximum (FWHM).
9. Full width at one-tenth maximum (FW(1/10)M).

If the spectrum is calibrated, both calibrated and channel values are given for items 1–9 above, and, in addition, the following is included:

10. The best match from the library.

If a match is found in the library, the following additional parameter is supplied:

11. The activity calculated using the net area, the live time, and the factor from the library.

4.1.7.1. Printing to a Printer and/or File

To print an **ROI Report**, leave both the **Print to file** and **Print to display** boxes unmarked. Click on either the **Paragraph** or **Column** radio button to select an output format. Make sure the correct printer is listed in the **Printer Name** field; to select another printer, click on the **Name** field and choose from the droplist. Click on **OK**.

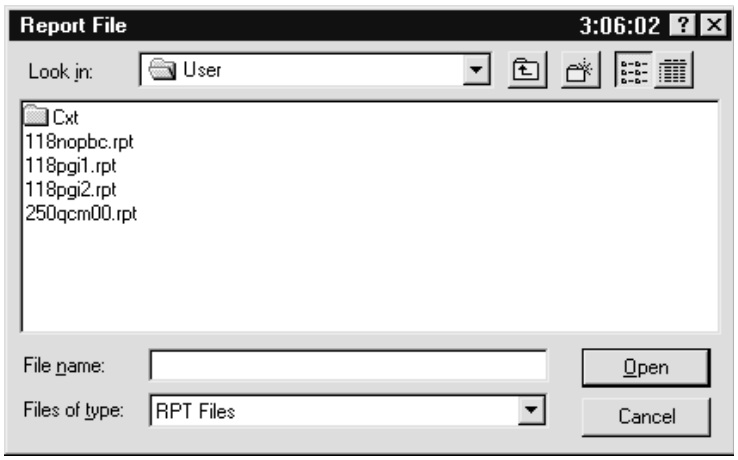


Fig. 36. Report Filename Selection.

To write an **ROI Report** to an ASCII file, follow the same steps but click on the **Print to file** box to mark it. Then click on **OK**. This will open the **Report File** dialog (see Fig. 36). Enter the desired **File name**: and click on **Open**. This file can then be viewed and printed from ASCII-text handlers such as Windows Notepad.

Examples of the **Paragraph**- and **Column**-style reports are shown in Figs. 38 and 37, respectively.

```
Detector #65537  ACQ 07-Jun-91 at  0:37:33   RT = 4219.8   LT = 3600.0
            No detector description was entered
            Mixed gamma Marinelli on endcap of P40268A

ROI # 1     RANGE: 332 = 57.12keV  to  360 = 61.64keV
            AREA : Gross =  224820    Net = 123784   +/- 714
            CENTROID: 346.17  = 59.40keV
            SHAPE: FWHM = 0.93     FW.2M = 1.45
            No close library match.

ROI # 2     RANGE: 509 = 85.70keV  to  537 = 90.22keV
            AREA : Gross =  449680    Net = 334221   +/- 881
            CENTROID: 522.55  = 87.89keV
            SHAPE: FWHM = 0.93     FW.2M = 1.44
            No close library match.
```

Fig. 37. Paragraph-Style ROI Report.

```
Detector #65537  ACQ 07-Jun-91 at  0:37:33   RT = 4219.8   LT = 3600.0
           No detector description was entered
           Mixed gamma Marinelli on endcap of P40268A
ROI#   RANGE (keV)    GROSS      NET   +/-  CENTROID FWHM  FW.2M  LIBRARY (keV)        Bq   +/-
 1   57.12   61.64   224820   123784   714    59.40  0.93   1.45  No close library match.
 2   85.70   90.22   449680   334221   881    87.89  0.93   1.44  No close library match.
 3  119.62  124.14   310370   223053   746   121.91  0.95   1.51  No close library match.
 4  133.99  138.52   101242    29253   552   136.33  0.97   1.55  No close library match.
 5  163.39  167.91   251299   176085   681   165.70  1.00   1.56  No close library match.
 6  252.54  257.39    62742     7728   486   254.90  1.02   1.65  No close library match.
 7  276.44  281.29    67265    21006   462   278.98  1.09   1.65  No close library match.
 8  388.85  394.02   217548   177819   597   391.48  1.20   1.86  No close library match.
 9  658.57  667.62   646572   590536  1032   661.39  1.39   2.15  No close library match.
```

Fig. 38. Column-Style ROI Report.

4.1.7.2. Print to display

Figures 39 and 40 show the **ROI Report** displayed on-screen in **Column** and **Paragraph** style. Remember that this report includes *only the ROIs currently displayed in the Expanded Spectrum View*.

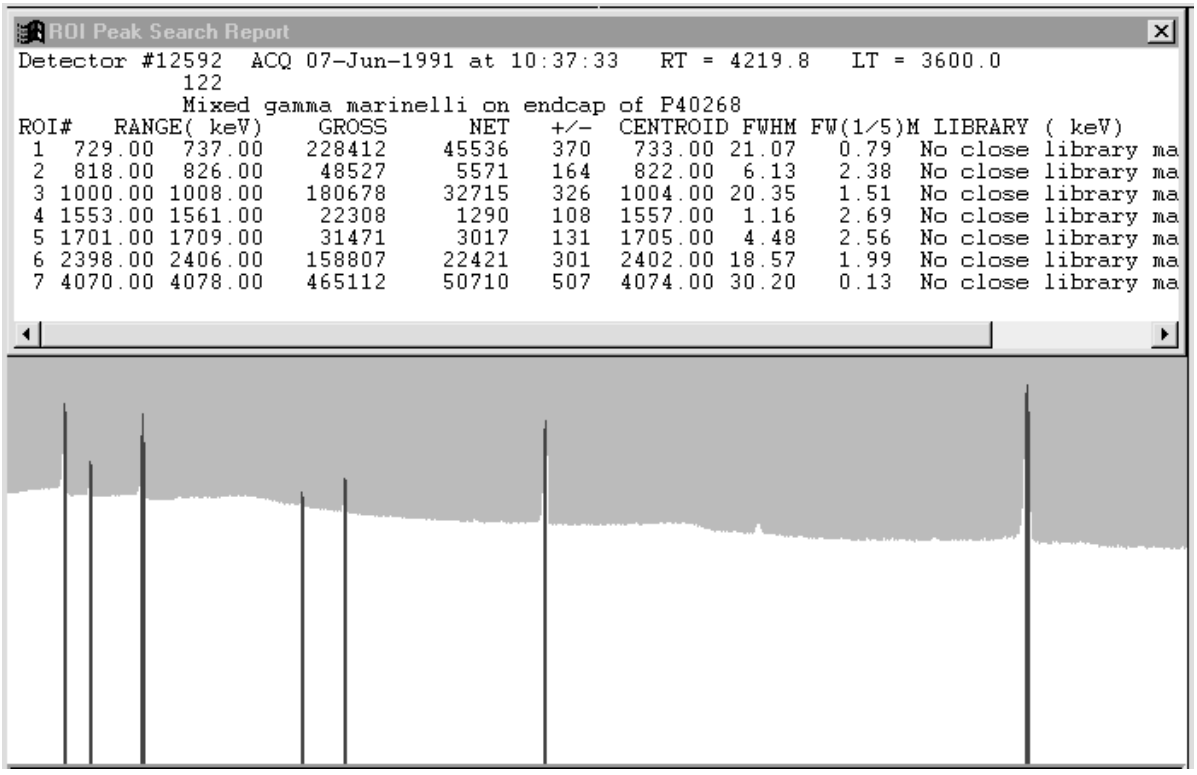


Fig. 39. Column-Style ROI Report On-Screen.

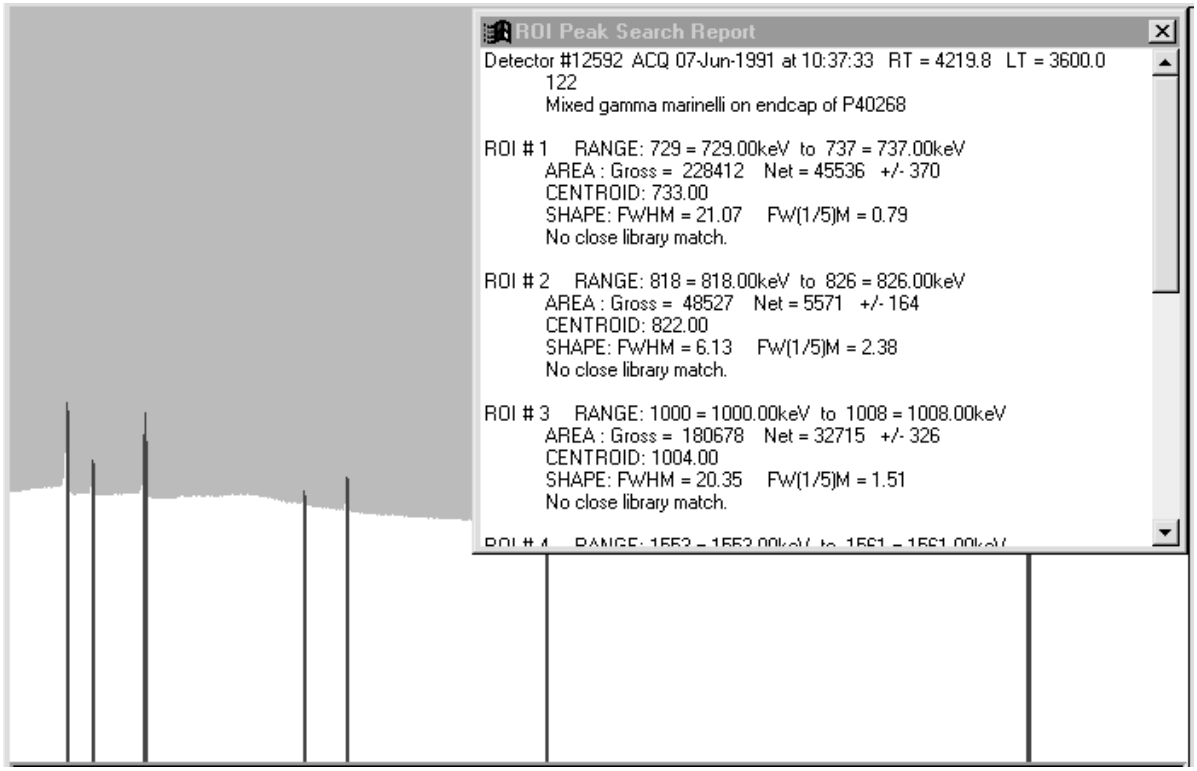

ROI Peak Search Report
Detector #12592 ACQ 07-Jun-1991 at 10:37:33 RT = 4219.8 LT = 3600.0
122
Mixed gamma marinelli on endcap of P40268
ROI # 1 RANGE: 729 = 729.00keV to 737 = 737.00keV
AREA : Gross = 228412 Net = 45536 +/- 370
CENTROID: 733.00
SHAPE: FWHM = 21.07 FW(1/5)M = 0.79
No close library match.
ROI # 2 RANGE: 818 = 818.00keV to 826 = 826.00keV
AREA : Gross = 48527 Net = 5571 +/- 164
CENTROID: 822.00
SHAPE: FWHM = 6.13 FW(1/5)M = 2.38
No close library match.
ROI # 3 RANGE: 1000 = 1000.00keV to 1008 = 1008.00keV
AREA : Gross = 180678 Net = 32715 +/- 326
CENTROID: 1004.00
SHAPE: FWHM = 20.35 FW(1/5)M = 1.51
No close library match.

Fig. 40. Paragraph-Style ROI Report On-Screen.

To close the report display window, click on its Close button ( ), or click on the control icon on the left of the title bar and select **Close** from the drop-down menu.

4.1.8. Compare...

This function displays a spectrum from disk along with the current spectrum so the two can be visually compared. A standard file-recall dialog box opens. Once the desired spectrum file is selected, the Expanded Spectrum View shows both spectra, as illustrated in Fig. 41.

Note that the spectra in this illustration are displayed in **Fill All** mode, in which all of the area under the peaks is filled with a color different from the background (see **Display/Preferences/ Fill All**, Section 4.6.11.1).

The Compare spectrum is offset from the starting spectrum, and can be moved up and down incrementally with the **<Shift + ↑>** and **<Shift + ↓>** accelerators. In addition, the vertical scale of both spectra can be simultaneously changed with <↑>/<↓>. Note that the Compare spectrum's ROIs (if any were saved with the file) are not marked in this mode.

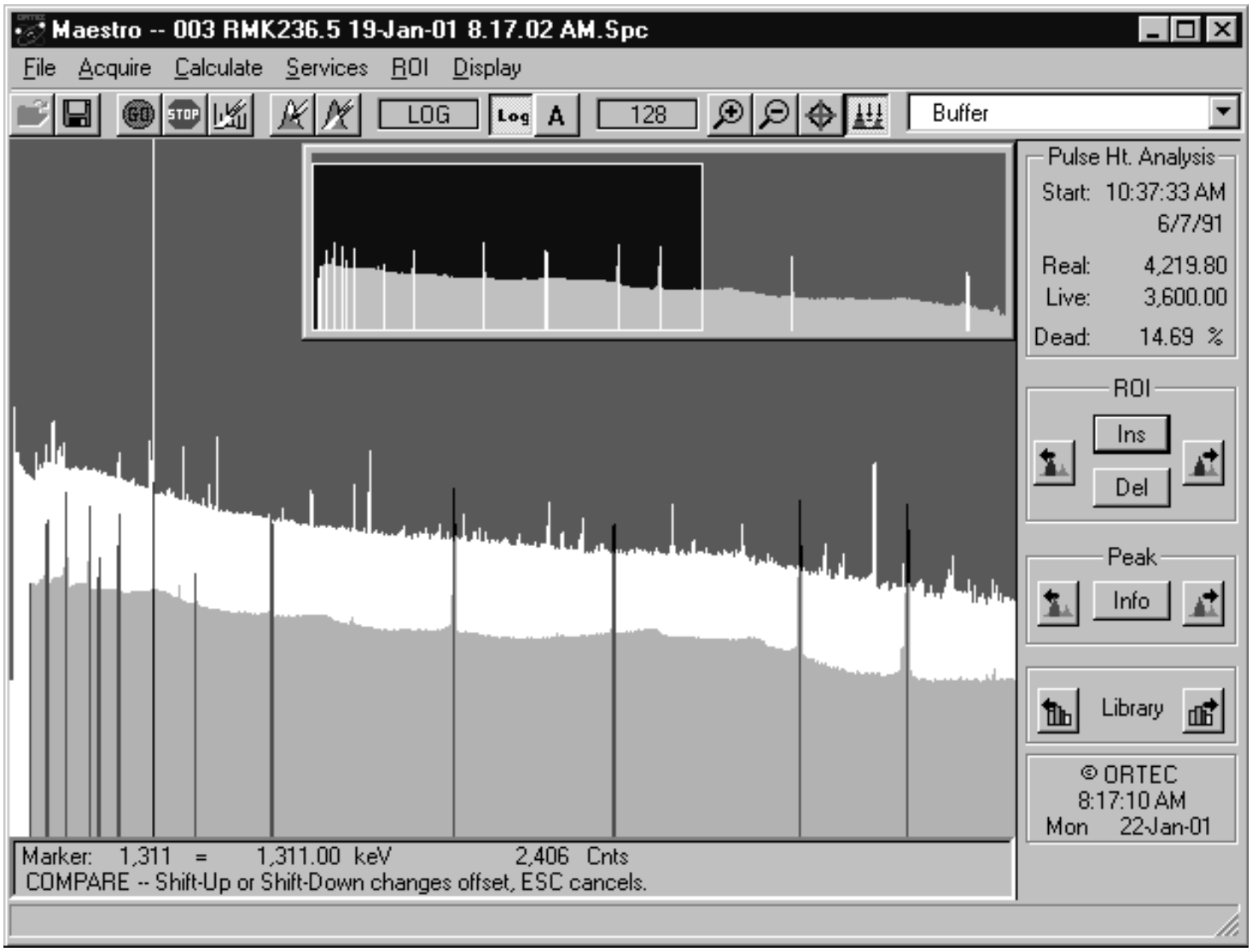


Fig. 41. Compare Mode Screen.

Figure 42 is a zoomed-in portion of Fig. 41. In this illustration, the starting spectrum is displayed in color **(1)**, the Compare spectrum is shown in color **(2)**, the starting spectrum's ROIs are marked in color **(3)**, and the portion of the starting spectrum that exceeds the Compare spectrum is indicated by color **(4)**. These colors — called **Foreground**, **Compare**, **ROI**, and **Composite**, respectively — are chosen on the **Color Preferences** dialog discussed in Section 4.6.11.2.

Press **<Esc>** to leave Compare mode.

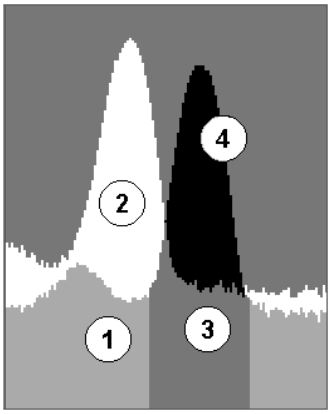


Fig. 42. Spectrum Colors in Compare Mode.

4.1.9. Exit

This exits MAESTRO and returns to Windows. If the buffer contains a spectrum that has not been saved, a warning message is displayed. Any JOBs are terminated. All MCBs continue acquisition.

4.1.10. About MAESTRO...

Figure 43 shows the **About** box for MAESTRO. It provides software version information that will be useful should you need customer support.

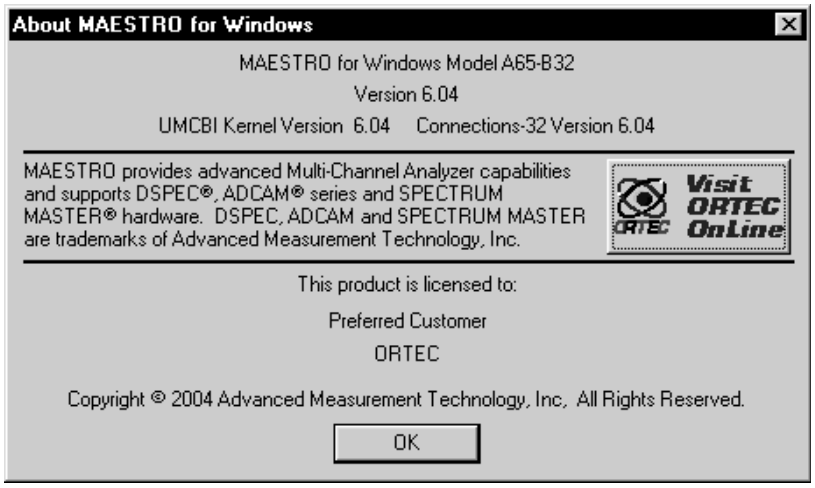

About MAESTRO for Windows
MAESTRO for Windows Model A65-B32
Version 6.04
UMCBI Kernel Version 6.04 Connections-32 Version 6.04
MAESTRO provides advanced Multi-Channel Analyzer capabilities and supports DSPEC®, ADCAM® series and SPECTRUM MASTER® hardware. DSPEC, ADCAM and SPECTRUM MASTER are trademarks of Advanced Measurement Technology, Inc.
Visit ORTEC OnLine
This product is licensed to:
Preferred Customer
ORTEC
Copyright © 2004 Advanced Measurement Technology, Inc, All Rights Reserved.
OK

Fig. 43. About MAESTRO.

If you are connected to the Internet, click on the **Visit ORTEC On-Line** button to browse our website which, in addition to our product catalog, includes application notes, technical papers, information on training courses, and access to our Global Service Center.

4.2. Acquire

The **Acquire** menu is shown in Fig. 44. Access to the various functions depends on whether the a Detector or buffer window is currently active. For example, if a buffer window is active, **Clear** is the only active Detector control and **MCB Properties...** is read-only. If a Detector window is active, **MCB Properties...** is interactive. The **Download Spectra** and **View ZDT Corrected** commands are available only for supported hardware (which is listed in the discussion for each of these functions).

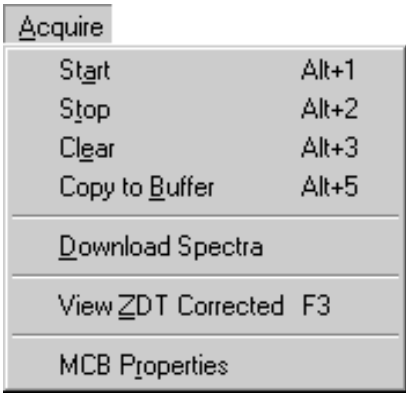


Fig. 44. Acquire Menu.

NOTE In some cases, a Detector option might be grayed because it is disabled for the current Detector (while it might still be valid for some other Detector in the system, or for this Detector under different conditions).

4.2.1. Start

This initiates data collection in the selected Detector. Any warnings arising from problems detected at the hardware level will appear in a message box or on the Supplemental Information Line at the bottom of the display. The Detector can also be started with the **<Alt + 1>** accelerator, the **Start Acquisition** button on the Toolbar, or the **Start** command on the right-mouse-button menu. If the Detector is already started or if a buffer is the active window, this entry is grayed.

4.2.2. Stop

Stop terminates data collection in the selected Detector. The display must be in Detector mode. If the Detector is not active, the entry is grayed. The Detector can also be stopped with the accelerator **<Alt+ 2>,** the **Stop Acquisition** button on the Toolbar, and the **Stop** command on the right-mouse-button menu.

4.2.3. Clear

Clear erases the spectral data and the descriptors (e.g., real time, live time, start time) for the currently active Detector or buffer window. The presets are not altered. (This function might not operate on some types of Detectors when they are collecting data.) The data can also be cleared with **<Alt+ 3>**, the **Clear Spectrum** button on the Toolbar, or the **Clear** command on the right-mouse-button menu.

4.2.4. Copy to Buffer

The **Copy to Buffer** function transfers the data and descriptors (e.g., live time, real time), from the selected Detector to a new buffer window. This function can also be performed with **<Alt + 5>**, the **Copy Spectrum to Buffer** Toolbar button, or the **Copy to Buffer** command on the right-mouse-button menu.

4.2.5. Download Spectra...

This command supports the Detective, trans-SPEC, digiDART, and DART, and is used to download the spectra from the MCB to the computer disk. The files are stored in the directory and format specified in the dialog under **File/Settings** (Section 4.1.1), and are named according to this format:

sss iiiiiiii ddddddddd ttttttttt.ext

where

sss is the sequence number as shown on the digiDART spectrum list display or the storage sequence in the DART.

iiiiiiii is the ID string entered on the digiDART when the spectrum was saved and shown on the digiDART spectrum list display or the text string from the barcode reader in the DART.

ddddddddd is the date the spectrum was collected, as recorded in the MCB.

ttttttttt is the time the spectrum was collected, as recorded in the MCB.

ext is the extension for the file type selected.

If any **Ask on Save Options** are set in the File Settings dialog, they will be asked for each spectrum individually. Note that if you cancel an ask-on-save prompt for a particular spectrum, any remaining ask-on-save prompts for that spectrum are not displayed, and the spectrum is not saved to disk.

The spectra are not erased from the MCB after download.

4.2.6. View ZDT Corrected

This command is active only for a Detector that supports Zero Dead-Time (ZDT) Mode[4] and that has a **ZDT** mode enabled on the ADC tab under **Acquire/MCB Properties...**. When the Detector is in a ZDT mode, two spectra are collected: either live-time corrected (LTC) and ZDT; or uncertainty (ERR) and ZDT (see Fig. 45 and the discussion in Section 4.2.7.6). The spectrum is labeled in the upper-right corner of the Full Spectrum View. When you choose **ZDT Display Select**, the ZDT spectrum is displayed, the **ZDT** label appears in the Full Spectrum View, and this command has a checkmark beside it on the menu. This function is duplicated by **<F3>**.

4.2.7. MCB Properties...

ORTEC ***CONNECTIONS-32*** applications now use a uniform data-acquisition setup dialog called Properties. In MAESTRO, the Properties dialog opens when you select the **Acquire/MCB Properties...** command. Two of our most commonly used Detectors — the DSPEC Pro and

[4]Patent number 6,327,549.

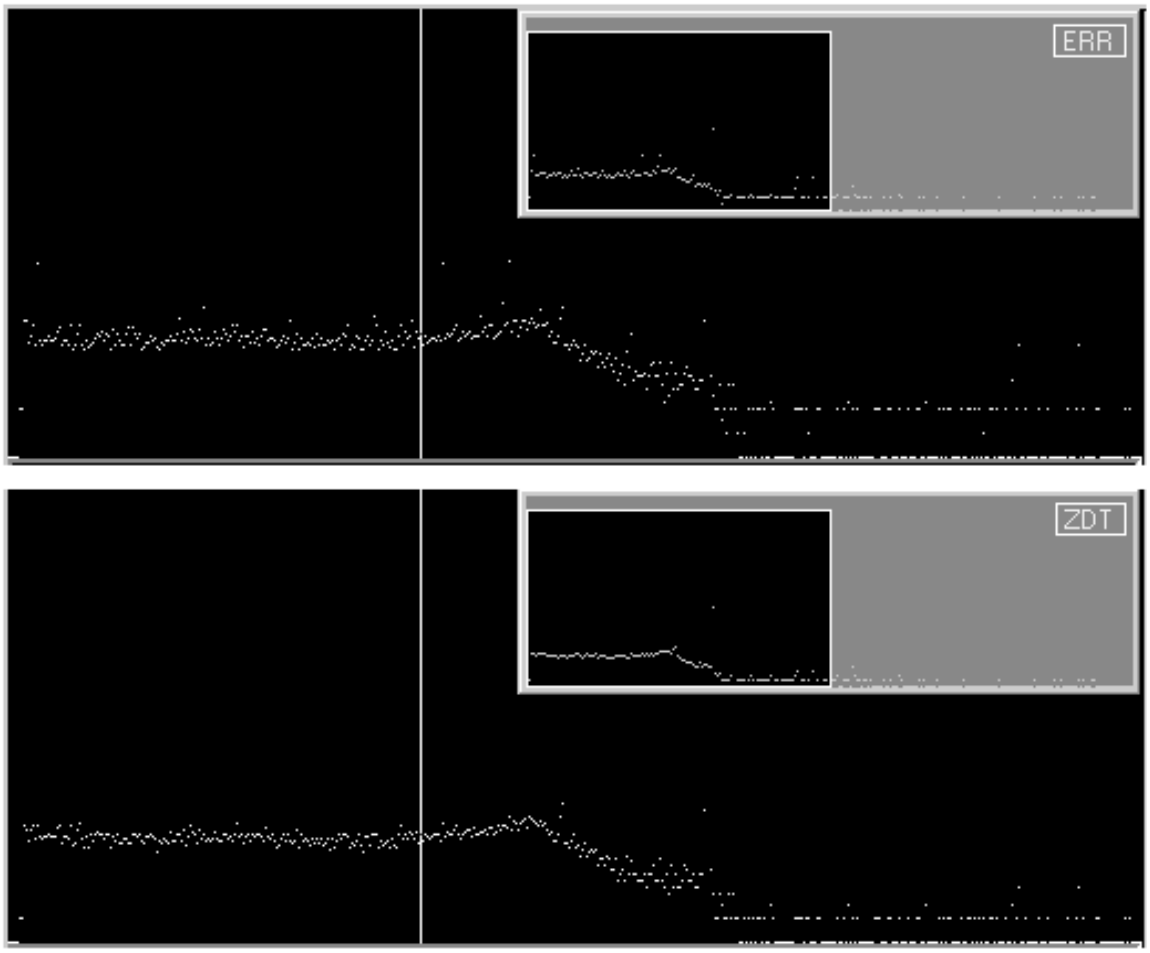


Fig. 45. Comparison of Uncertainty and ZDT Spectra Showing Labels in Full Spectrum View.

digiDART — are described here. To see the Properties dialogs for our other ***CONNECTIONS***-compliant MCBs, see the MCB Properties manual.

Depending on the currently selected MCB, the Properties dialog displays several tabs of hardware controls including ADC setup parameters, acquisition presets, high-voltage controls, amplifier gain adjustments, gain and zero stabilizers, pole-zero and other shaping controls, and access to the InSight™ Virtual Oscilloscope. In addition, the Status tab for certain MCBs monitors conditions such as alpha chamber pressure, detector status, charge remaining on batteries, and the number of spectra collected in remote mode. Find your Detector's setup section here or in the MCB Properties manual, move from tab to tab and set your hardware parameters, then click on **Close**. Note that as you enter characters in the data-entry fields, the characters will be underlined until you move to another field or until 5 seconds have lapsed since a character was last entered. During the time the entry is underlined, no other program or PC on the network can modify this value.

If the Detector is locked (see Section 4.4.4), you must know the password before you can modify its MCB properties. To view a locked Detector's properties in read-only mode, click on **Cancel** when the Unlock Password dialog opens.

4.2.7.1. DSPEC Pro

Amplifier

Figure 46 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and **Optimize**.

NOTE Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button. The changes you make on most property tabs *take place immediately*. There is no cancel or undo for these dialogs.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.45 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.45 to 32.

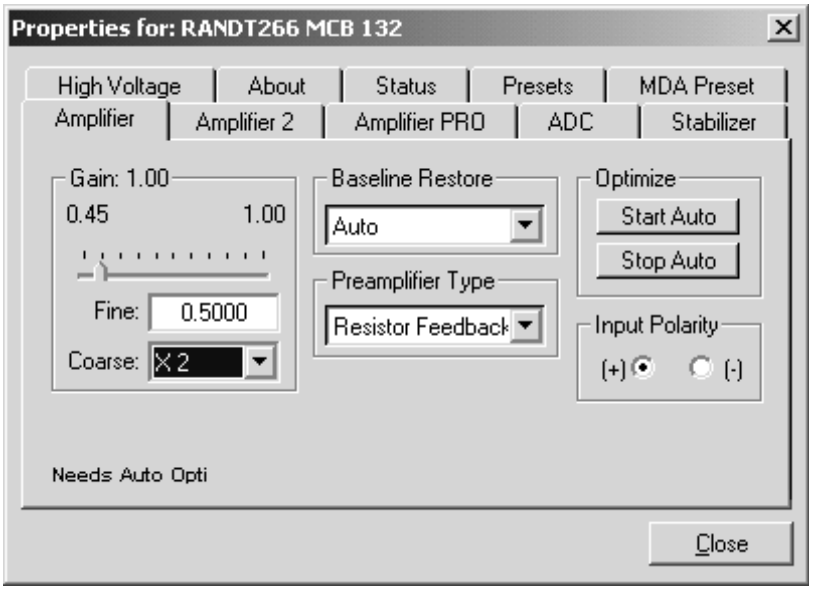


Fig. 46. DSPEC Pro Amplifier Tab.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise from dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[5] **Fast**, and **Slow**). The fast

[5]Patent number 5,912,825.

setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (**Auto**, **Fast**, or **Slow**) are saved in the DSPEC Pro even when the power is off. The time constant can be manually set on the InSight display (see the discussion in Section 4.2.7.3).

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, page 77). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 67). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type

Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the germanium detector being used.

Optimize

The DSPEC Pro is equipped with both automatic pole-zero logic[6] and automatic flattop logic.[7] The **Start Auto** (optimize) button uses these features to automatically choose the best pole zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this DSPEC Pro, the optimize button does not perform the pole zero.

As with any system, the DSPEC Pro should be optimized any time the detector is replaced or if the flattop width is changed. For optimization to take place, the DSPEC Pro must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the DSPEC Pro front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto**. The optimize command is sent to the DSPEC Pro at this time and, if the DSPEC Pro is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeping stops.

During optimization, pole zeroes are performed for several rise-time values and the DSPEC Pro is cycled through all the rise time values for the determination of the optimum tilt values. As all of the values for all the combinations are maintained in the DSPEC Pro, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

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[6]Patent number 5,872,363.

[7]Patent number 5,821,533.

You should repeat the optimization if you change the flattop width.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape may not change enough for you to see. (In this situation, you also may not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

Amplifier 2

Figure 47 shows the Amplifier 2 tab, which accesses the advanced DSPEC Pro shaping controls including the InSight Virtual Oscilloscope mode.

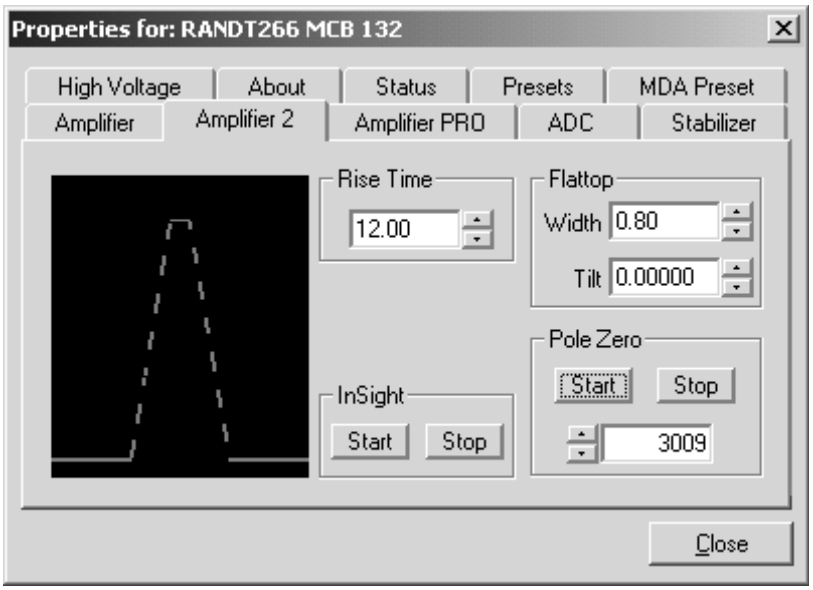


Fig. 47. DSPEC Pro Amplifier 2 Tab.

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. The value of the rise time parameter in the DSPEC Pro is roughly equivalent to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a DSPEC Pro value of 12 µs corresponds to 6 µs in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the **Rise Time** within the range of 0.8 to 23.0 µs. After all the controls have been adjusted, return to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the DSPEC Pro firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **Insight** section on the Amplifier 2 tab and click on **Start**. The InSight mode is discussed in more detail in the following section.

Note that the Amplifier 2 tab graphically presents a *modeled shape*. This is *not* a sampled waveform of the actual pulse shape, only a model based on the current parameters. The modeled

shape is nominally a quasi-trapezoid whose sides and top may be adjusted by the controls in this dialog. While a particular control is being adjusted, the model is updated to represent the changes made.

The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 μs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

The dead time per pulse is $(3 \times \textit{Rise Time}) + (2 \times \textit{Flattop Width})$.

In the **Pole Zero** section, the **Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The pole-zero **Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user may wish to return to **MCB Properties...** and click on the **Insight** section's **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well.

Amplifier PRO

This tab (Fig. 48) contains the controls for the **Low Frequency Rejector** (LFR) filter, **Resolution Enhancer**, and **Enhanced Through-put Mode**. To enable a particular feature, mark the corresponding checkbox. Any or all of these features can be used at one time, however, the LFR and enhanced throughput modes must be set up before the resolution enhancer is configured, as discussed below. Note that once an MCB is "trained" for the **Resolution Enhancer** (see the following section), it must be "retrained" if any settings are changed that can affect peak shape or position (e.g., bias, gain, rise time, flattop, PZ).

Low Frequency Rejector[8] — See the DSPEC Pro hardware user's manual for a discussion of this feature. You *cannot* optimize or pole-zero the DSPEC Pro while in LFR mode. The **Optimize** feature should be used with the LFR filter *off*. Subsequent measurements can then be taken with the LFR filter on. Also, LFR mode affects the available range of protection times in **Enhanced Throughput Mode**, as discussed in the next paragraph.

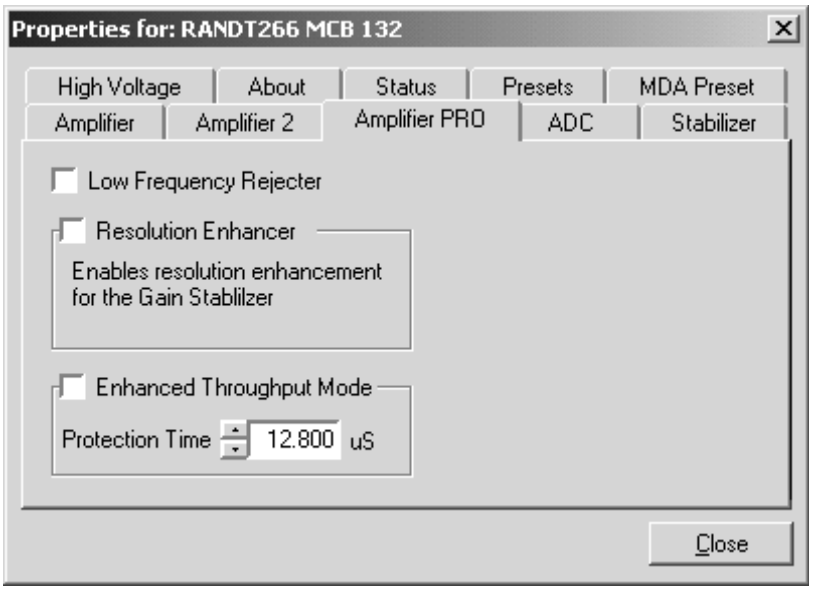


Fig. 48. DSPEC Pro Amplifier PRO Tab.

Enhanced Throughput Mode — See the DSPEC Pro hardware user's manual for a discussion of this feature. The valid **Protection Time** settings, in 25-ns increments, are:

- LFR mode off 1.1 µs to 48.4 µs
- LFR mode on 3.0 µs to 145.2 µs

Turning on this feature automatically sets the minimum protection time (highest throughput rate) based on your current **Rise Time** and **Flattop** settings, however, you can adjust this value at any time. Each time you change the rise time or flattop, the DSPEC Pro will automatically set itself to the new minimum protection time.

"Training" the Resolution Enhancer

The resolution enhancer can help alleviate the low-side peak tailing that results from increased charge trapping; see the discussion in the DSPEC Pro hardware manual. This function will *not* improve low resolution due to other causes (and might exacerbate the problem).

1. Set the bias, gain, rise time, flattop, and PZ as you would for data collection.

2. If you wish to use LFR Mode, turn it on.

3. If you wish to use Enhanced Throughput Mode, turn it on and either accept the automatically calculated, highest-throughput protection time, based on the current rise time and flattop; or enter the desired setting. (The latter might require one or more data acquisitions. When finished, proceed to Step 4).

[8]Patent pending.

4. Clear the MCB and acquire a well-isolated peak.

5. You will now use the gain stabilization section of the Stabilizer tab to configure the resolution enhancer. (The gain stabilizer and resolution are somewhat similar in function, and only one of these features can be used at a time.) Enter the **Center** channel and **Width** of the peak acquired in Step 4; the maximum **Width** is 255 channels. If you wish, use the **Suggest** button.

6. If you have already used the resolution enhancer, you can either use the previously established settings (which will go into effect when you turn on the enhancer in Step 7), or click on **Initialize** to clear all settings. Initialization does not change the current **Center** channel and **Width**.

7. Return to the PRO tab and turn on the resolution enhancer.

8. Clear the MCB, re-start acquisition, and monitor the FWHM of the target peak until it no longer changes. Typically, the more charge trapping exhibited by the detector, the longer the data collection time.

9. When you are satisfied that the FWHM has reached the best possible value, clear the MCB and collect another spectrum for confirmation.

10. At this point, the resolution enhancer is now "trained" for the current peak shape parameters and can be turned off. (You can leave it on, if you wish, but you might notice some peak broadening.)

11. If you change any parameters that affect peak position and/or shape, you must repeat this "training" procedure.

ADC

This tab (Fig. 49) contains the **Gate**, **ZDT Mode**, **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector

signal. The gating signal must occur prior to and extend 500 ns beyond peak detect (peak maximum).

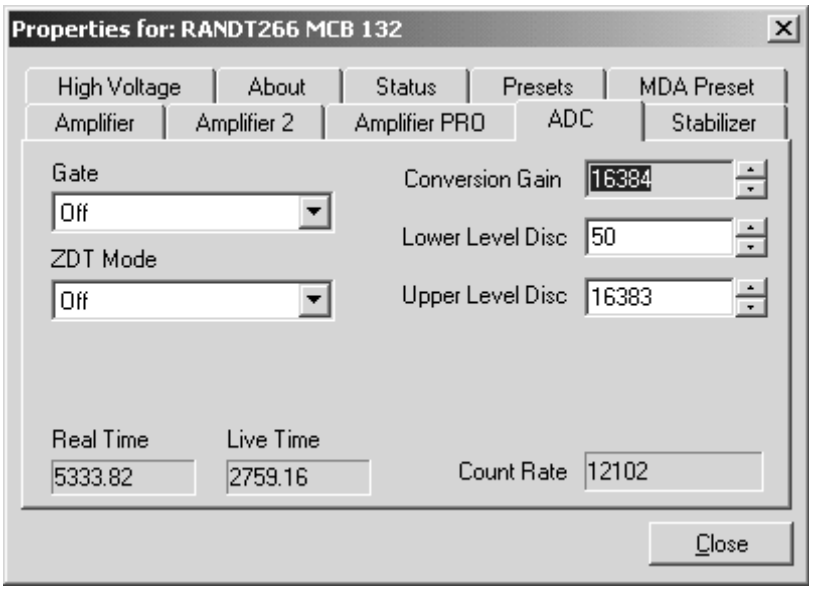


Fig. 49. DSPEC Pro ADC Tab.

ZDT Mode

Use this droplist to choose the **ZDT Mode** to be used for collecting the zero dead time (corrected) spectrum (see Section 4.2.7.6). The three modes are **Off** (LTC only), **NORM_CORR** (LTC and ZDT), and **CORR_ERR** (ERR and ZDT). If one of the ZDT modes is selected, both spectra are stored in the same spectrum (`.SPC`) file. If you do not need the ZDT spectrum, you should select **Off**.

In MAESTRO, the display can show either of the two spectra. Use **<F3>** or **Acquire/ ZDT Display Select** to toggle the display between the two spectra. In the Compare mode, **<F3>** switches both spectra to the other type and **<Shift+F3>** switches only the compare spectrum. This allows you to make all types of comparisons.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048). The up/down arrow buttons step through the valid settings for the DSPEC Pro.

Upper- and Lower-Level Discriminators

In the DSPEC Pro, the lower- and upper-level discriminators are under computer control. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff by channel number for ADC conversions.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff by channel number for storage.

Stabilizer

The DSPEC Pro has both a gain stabilizer and a zero stabilizer (see Sections 4.2.7.4 and 4.2.7.5). The Stabilizer tab (Fig. 50) shows the current values for the stabilizers. The value in

each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

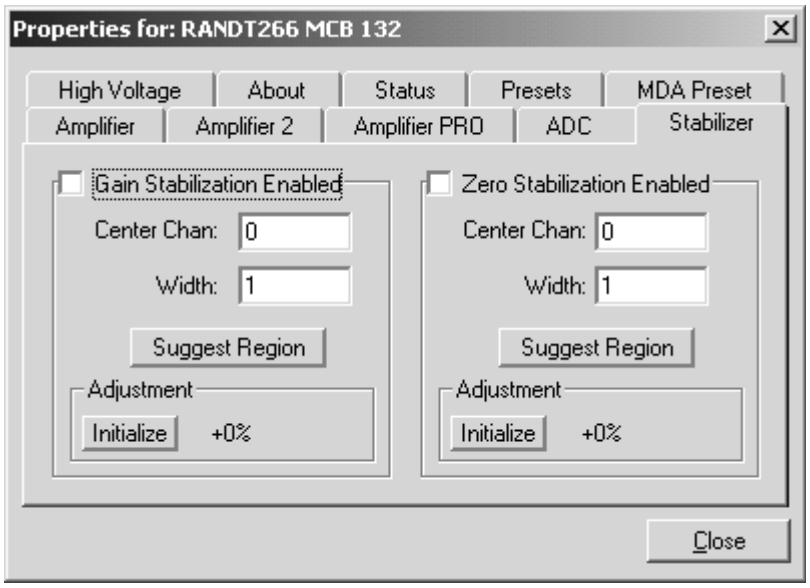


Fig. 50. DSPEC Pro Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appro-priate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

High Voltage

Figure 51 shows the High Voltage tab, which allows you to turn the high voltage on or off; set and monitor the voltage; and choose the **Shutdown** mode. The polarity is set in the DIM module.

Fig. 51. DSPEC Pro High Voltage Tab.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The shutdown can be **ORTEC**, **TTL**, or **SMART**. The **ORTEC** mode is used for all ORTEC detectors except SMART-1 detectors. Use the **SMART** option for those detectors. Check with the detector manufacturer for other detectors. The **TTL** mode is used for most non-ORTEC detectors.

The high voltage in the DSPEC Pro is supplied by the SMART-1 module or in a separate DIM. The recommended HV for SMART-1 is displayed on the dialog. For other detectors, see the detector manual or data sheet for the correct voltage. The polarity is determined by the DIM or SMART-1 module.

To use a **Sodium Iodide Detector**, mark the checkbox. This changes the gain and zero stabilizers to operate in a faster mode. For the DIM-296, the HV is controlled by the adjustment in the Model 296 and not here.

About

This tab (Fig. 52) displays hardware and firmware information about the currently selected DSPEC Pro as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the Detector is currently locked with a password (see Section 4.4.4). **Read/Write** indicates that the Detector is unlocked; **Read Only** means it is locked.

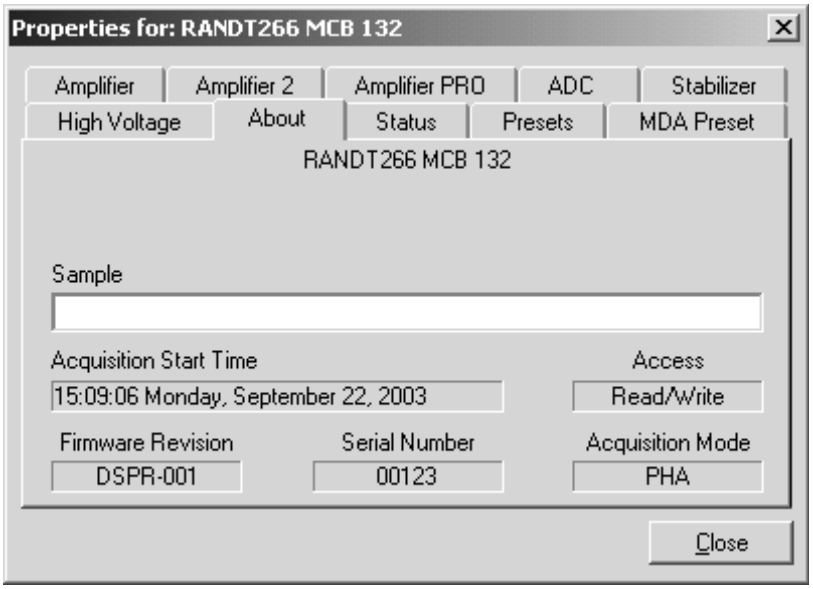


Fig. 52. DSPEC Pro About Tab.

Status

Figure 53 shows the Status tab. There are 21 values monitored at all times. You can select any six of these to be displayed simultaneously on the Status tab. The parameters you choose can be changed at any time, so you can view them as needed. Two types of values are presented: **OK** or **ERR**, and numeric value. The state-of-health (SOH) parameters are all **OK** or **ERR**. If the state is **OK**, the parameter stayed within the set limits during the spectrum acquisition. If the parameter varied from the nominal value by more than the allowed limit, the **ERR** is set until cleared by the program. The numeric values are displayed in the units reported

by the DSPEC Pro. **Security**, **Detector temperature**, and **Live detector temperature** are available only for SMART-1 detectors. For non-SMART-1 detectors, they show **N/A**.

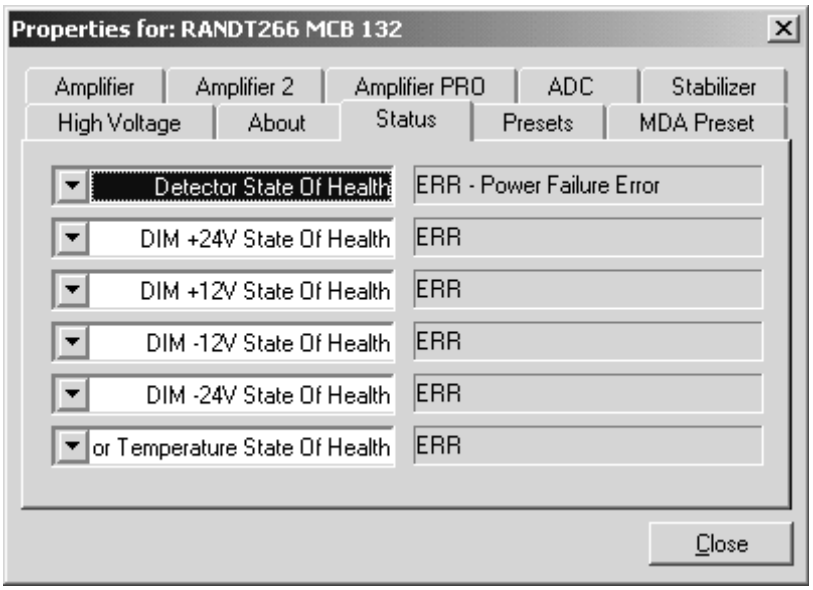


Fig. 53. DSPEC Pro Status Tab.

The parameters displayed are:

Detector State of Health
This is OK if all the SOH are OK and ERR if any one is ERR.

DIM +24V State of Health
This is OK if the +24 volt supply in the DIM has stayed within 200 mV of +24 volts since the last time the SOH was cleared.

DIM +12V State of Health
This is OK if the +12 volt supply in the DIM has stayed within 200 mV of +12 volts since the last time the SOH was cleared.

DIM -12V State of Health
This is OK if the −12 volt supply in the DIM has stayed within 200 mV of −12 volts since the last time the SOH was cleared.

DIM -24V State of Health
This is OK if the −24 volt supply in the DIM has stayed within 200 mV of −24 volts since the last time the SOH was cleared.

Temperature State of Health
This is OK if the detector temperature has stayed below the high temperature limit set in the detector since the last time the SOH was cleared. This is available only for SMART-1 detectors.

High Voltage State of Health
This is OK if the HV supply in the DIM has stayed within 200 V of specified bias voltage since the last time the SOH was cleared.

Shutdown State of Health

This is OK if the detector shutdown has not activated since the last time the SOH was cleared.

Preamplifier overload State of Health

This is OK if the preamplifier overload has not activated since the last time the SOH was cleared.

Security State of Health

This is OK if the security test was passed at the end of the last spectrum acquisition. This is available only for SMART-1 detectors.

Power State of Health

This is OK if the power to the DIM was constant during the last spectrum acquisition.

+24 volts

This is the current value of the +24 volt supply in the DIM as delivered to the detector.

+12 volts

This is the current value of the +12 volt supply in the DIM as delivered to the detector.

−12 volts

This is the current value of the -12 volt supply in the DIM as delivered to the detector.

−24 volts

This is the current value of the -24 volt supply in the DIM as delivered to the detector.

High Voltage

This is the current value of the high voltage bias supply in the DIM as delivered to the detector.

Detector temperature

This is the detector temperature at the time the current spectrum acquisition stopped. This is available only for SMART-1 detectors.

Live detector temperature

This is the detector temperature at the current time. This is available only for SMART-1 detectors.

Battery voltage

This is not used in the DSPEC Pro.

Battery % full

This is not used in the DSPEC Pro.

Battery time remaining

This is not used in the DSPEC Pro.

Presets

Figure 54 shows the Presets tab. MDA presets are shown on a separate tab.

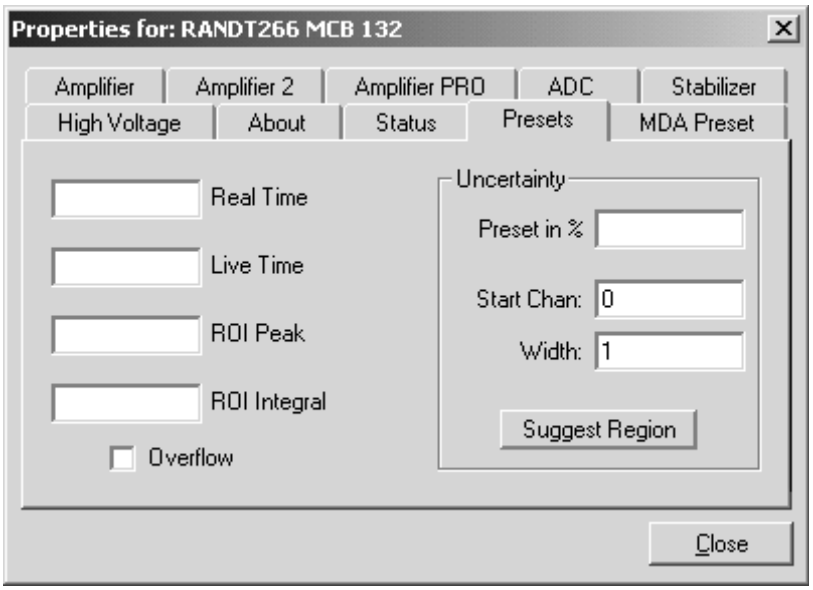


Fig. 54. DSPEC Pro Presets Tab.

The presets can only be set on a Detector that is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount

of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the Detector stops counting when any ROI channel reaches this value unless there are no ROIs marked in the Detector, in which case that Detector continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the Detector stops counting when the sum of all counts in all channels for this Detector marked with an ROI reaches this value. This has no function if no ROIs are marked in the Detector.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample may be lower than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM.

The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^{9}) counts.

MDA Preset

The MDA preset (Fig. 55) can monitor up to 20 nuclides at one time, and stops data collection when the values of the *minimum detectable activity* (MDA) for all of the user-specified MDA nuclides reach the needed value. The MDA preset is implemented in the hardware. The formula for calculating the MDA can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * (Eff * Yield)}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from external programs. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

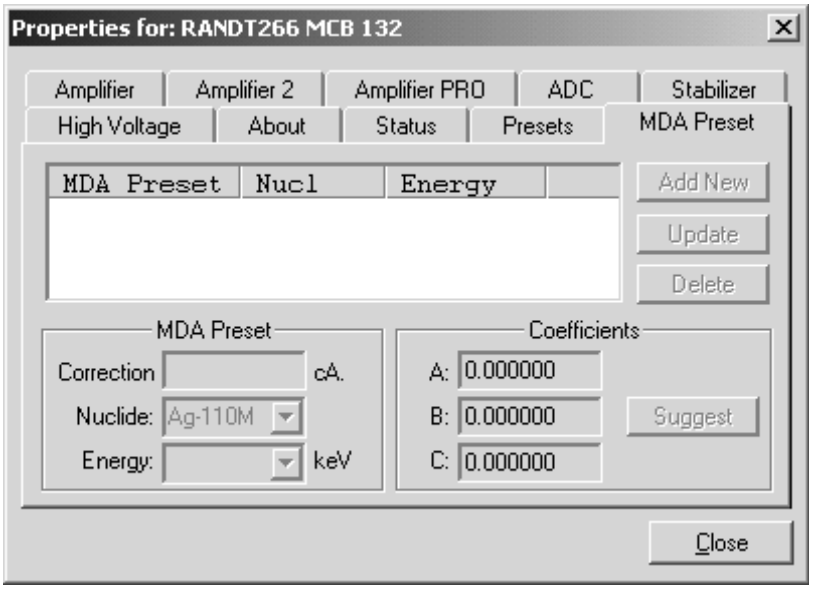


Fig. 55. DSPEC Pro MDA Preset Tab.

Coefficients A, **B**, and **C** can be entered as numbers for the MDA calculation desired.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

The **MDA** field is labeled **Correction** because MAESTRO does not use efficiency. In this case, the *Eff* value is set to 1.0. The *Yield* value is taken from the library. If the **Correction** value entered is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

4.2.7.2. digiDART

Amplifier

Figure 56 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and optimization. Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog.*

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.45 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.45 to 100.

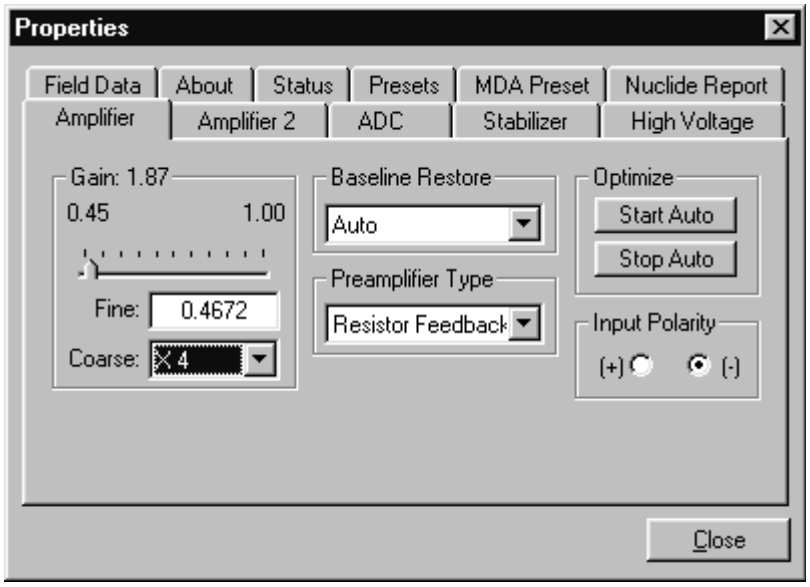


Fig. 56. digiDART Amplifier Tab.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise such as dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[5] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (**Auto**, **Fast**, or **Slow**) are saved in the digiDART even when the power is off. The time constant can be manually set on the InSight display (see the discussion in Section 4.2.7.3).

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, page 77). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 67). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type

Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the type of germanium detector being used.

Optimize

The digiDART is equipped with both automatic pole-zero logic[6] and automatic flattop logic.[7] The **Start Auto** optimization button uses these features to automatically choose the best pole

zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this digiDART, the **Start Auto** button does not perform the pole zero.

As with any system, the digiDART should be optimized any time the detector is replaced or if the flattop width is changed. For optimization to take place, the digiDART must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the digiDART front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto**. The optimize command is sent to the digiDART at this time and, if the digiDART is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeping stops.

During optimization, pole zeroes are performed for several rise-time values and the digiDART is cycled through all the rise time values for the determination of the optimum tilt values. As all of the values for all the combinations are maintained in the digiDART, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

You should repeat the optimization if the flattop width is changed.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape might not change enough for you to see. (In this situation, you also might not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

Amplifier 2

Figure 57 shows the Amplifier 2 tab, which accesses the advanced digiDART shaping controls including the InSight Virtual Oscilloscope mode, which is discussed in Section 4.2.7.3.

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. Section 4.2.7.6 discusses this tradeoff and contains a guide to choosing rise time according to count rate. The value of the rise time parameter in the digiDART is roughly equivalent to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a digiDART value of 12 corresponds to 6 in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise

time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the rise time within the range of 0.2 to 23.0. After all the controls have been adjusted, return to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the digiDART firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **InSight** section on the Amplifier 2 tab and click on **Start**.

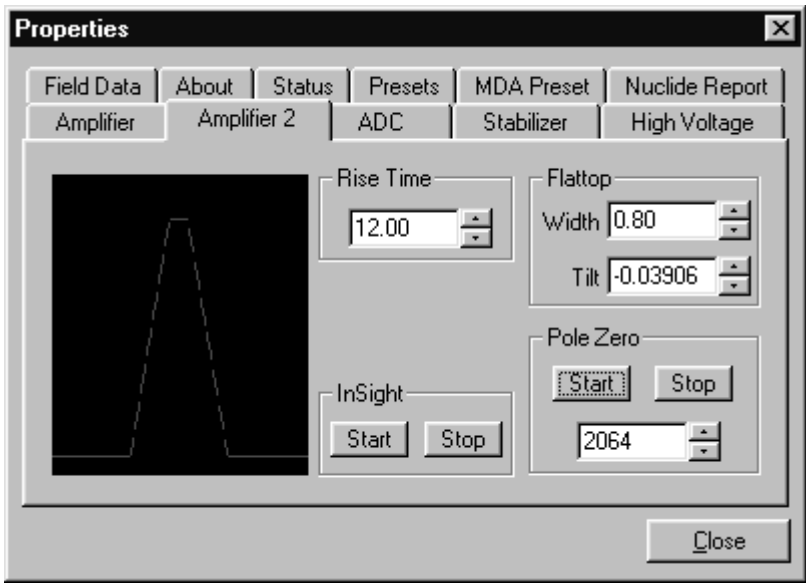


Fig. 57. digiDART Amplifier 2 Tab.

Note that the Amplifier 2 tab graphically presents a *modeled shape*. This is *not* a sampled waveform of the actual pulse shape, only a model based on the current parameters. The modeled shape is nominally a quasi-trapezoid whose sides and top can be adjusted by the controls in this dialog. While a particular control is being adjusted, the model is updated to represent the changes made.

The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 µs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

The dead time per pulse is $(3 \times \textit{Rise Time}) + (2 \times \textit{Flattop Width})$.

In the **Pole Zero** section, the **Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The pole-zero **Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user might wish to select **MCB Properties...** and click on the **InSight** section's **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well.

ADC

This tab (Fig. 58) contains the **Gate**, **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

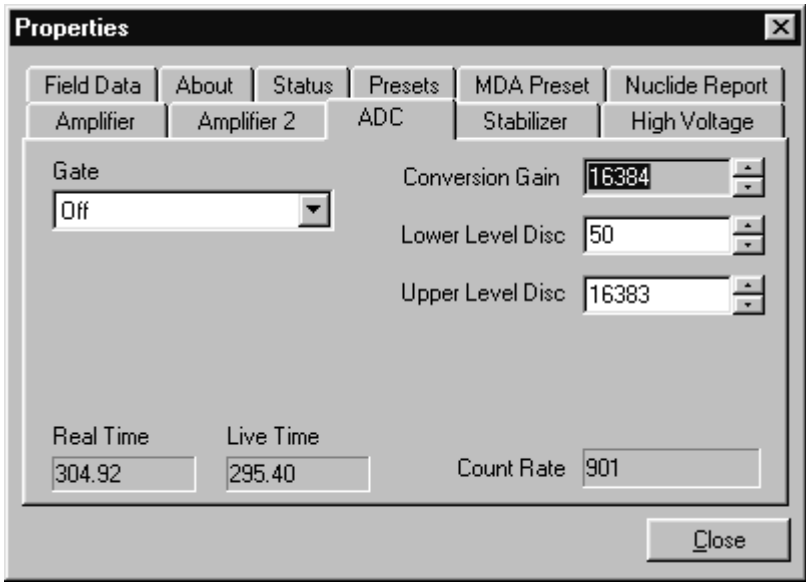


Fig. 58. digiDART ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings for the digiDART.

Upper- and Lower-Level Discriminators

In the digiDART, the lower- and upper-level discriminators are under computer control. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff, by channel number, for ADC conversions. Setting that level above random noise increases useful throughput because the MCB is not unproductively occupied processing noise pulses.

The **Upper Level Discr**iminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for ADC conversions.

Stabilizer

The digiDART has both a gain stabilizer and a zero stabilizer (see Sections 4.2.7.4 and 4.2.7.5).

The Stabilizer tab (Fig. 59) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

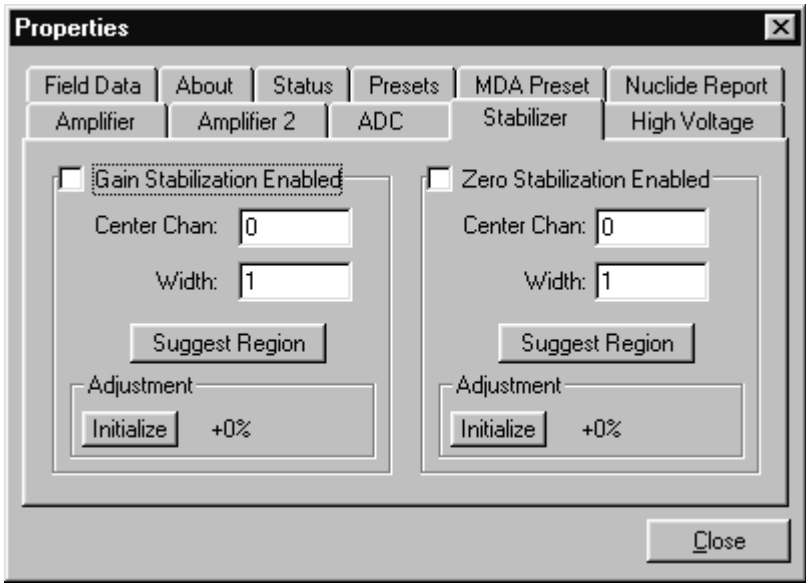


Fig. 59. digiDART Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

High Voltage

Figure 60 shows the High Voltage tab, which allows you to turn the high voltage on or off, set and monitor the voltage, and choose the **ShutDown** mode.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The shutdown can be **ORTEC**, **TTL** or **SMART**. The **ORTEC** mode is used for all **ORTEC** detectors except SMART-1 detectors; use the SMART option for those detectors. Check with the detector manufacturer for other detectors. The **TTL** mode is used for most non-ORTEC detectors.

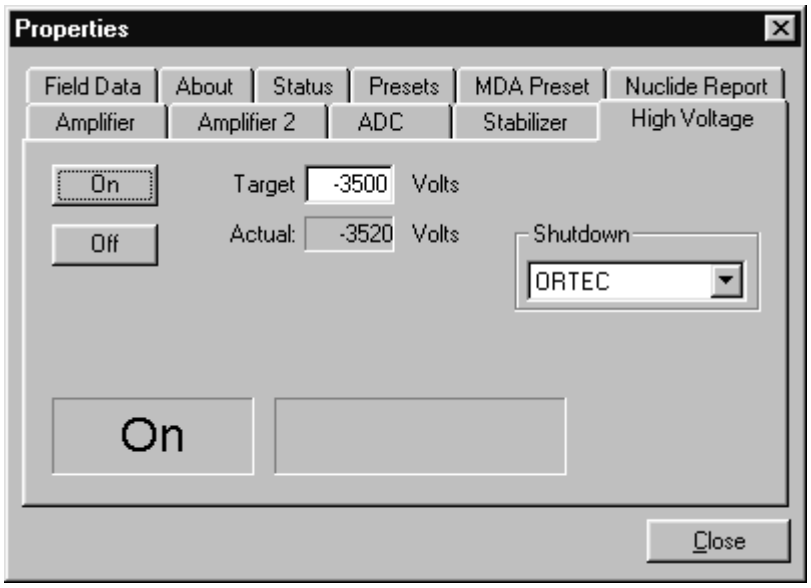


Fig. 60. digiDART High Voltage Tab.

The high voltage in the digiDART is supplied by the SMART-1 module or in a separate DIM. The recommended HV for SMART-1 is displayed on the dialog. For other detectors, see the detector manual or data sheet for the correct voltage. The polarity is determined by the DIM or SMART-1 module.

Field Data

This tab (Fig. 61) is used to view the digiDART spectra collected in Field Mode, that is, in remote mode, detached from a PC. The digiDART is always in Field Mode when disconnected from the PC. The spectrum can then be viewed as the "active" spectrum in the digiDART. The active spectrum is the spectrum where the new data are collected. The current active spectrum is lost.

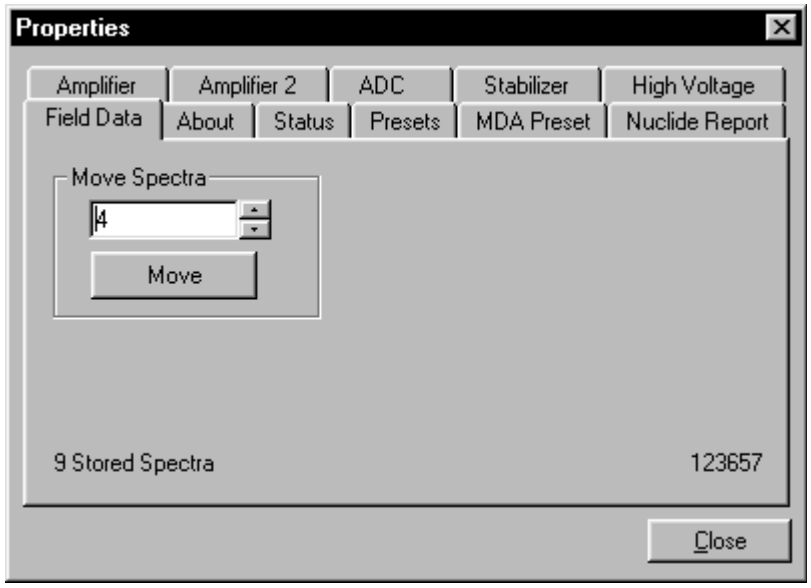


Fig. 61. The digiDART Field Mode Spectrum Tab.

The lower left of the tab shows the total number of spectra (not counting the active spectrum) stored in the digiDART memory. The spectrum ID of the active spectrum is shown in the lower right. The spectrum ID is the eight-character alphanumeric value stored with the spectrum. The stored spectra cannot be viewed or stored in the PC until they are moved to the active spectrum position.

To move a spectrum from the stored memory to the active memory, enter the spectrum number and click on **Move**. Use the up/down arrow buttons to scroll through the list of spectra. The label

on the lower right does not update until a spectrum is moved. The numbers are the same as the numbers shown on the digiDART display in the stored spectrum list. Note that this only moves the spectrum inside the digiDART. To save the current active spectrum to the PC disk, use the **File/Save** commands in the application.

The **Acquire/Download Spectra** command can also be used to download all the stored spectra and save them to disk automatically. They can then be viewed in a buffer window.

About

This tab (Fig. 62) displays hardware and firmware information about the currently selected digiDART as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password (see Section 4.4.4). **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

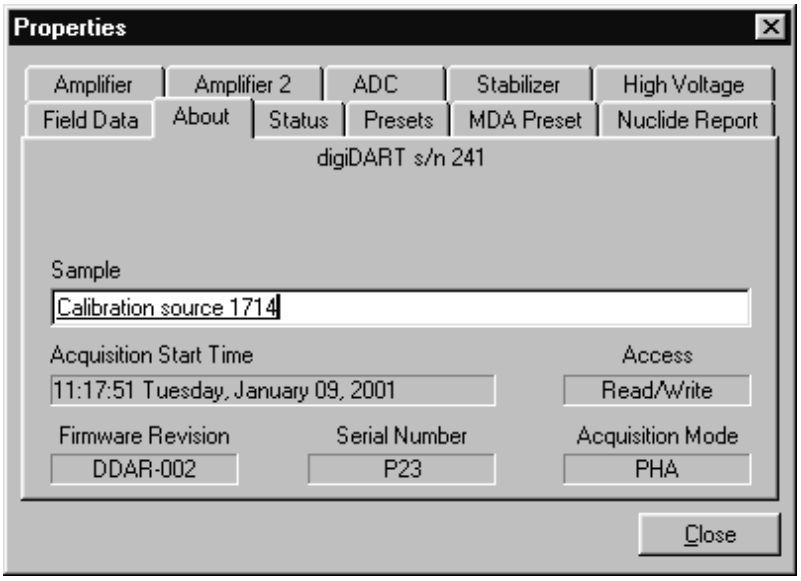


Fig. 62. digiDART About Tab.

Status

Figure 63 shows the Status tab. Twenty-one parameters are monitored at all times. Use the droplists to select any six parameters to be displayed simultaneously on the Status tab (normally these would be the six that are most important to you). The items you select can be changed at any time.

Two types of status responses are displayed: **OK** or **ERR**, and a numeric value. The state-of-health (SOH) parameters all respond with **OK** or **ERR**. If the state is **OK**, the parameter stayed within the set limits during the spectrum acquisition. If the parameter varied from the nominal value by more

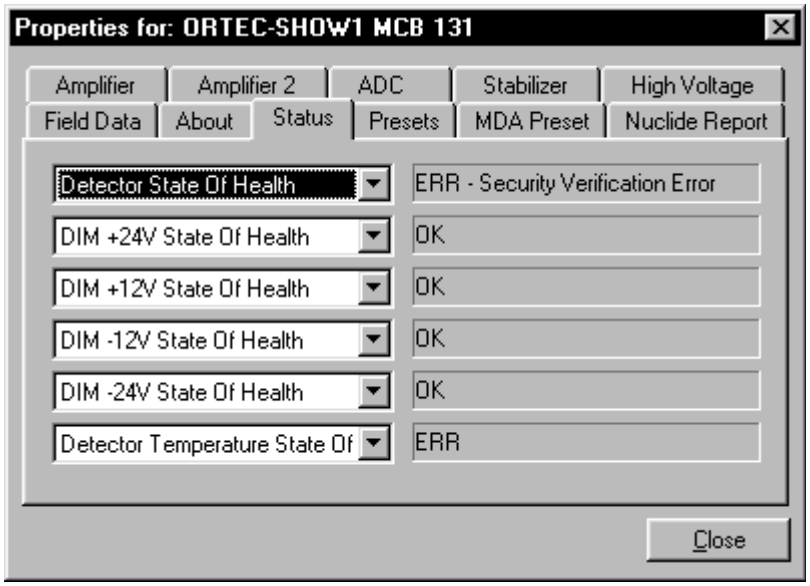


Fig. 63. digiDART Status Tab.

than the allowed limit, the **ERR** is set until cleared by the program. The numeric values are displayed in the units reported by the digiDART. **Security**, **Detector temperature**, and **Live detector temperature** are available only for SMART-1 detectors. For non-SMART-1 detectors, they respond with **N/A**.

The parameters are:

Detector State of Health
This is OK if all the SOH are OK and ERR if any one is ERR.

DIM +24V State of Health
This is OK if the +24 volt supply in the DIM has stayed within 200 mV of +24 volts since the last time the SOH was cleared.

DIM +12V State of Health
This is OK if the +12 volt supply in the DIM has stayed within 200 mV of +12 volts since the last time the SOH was cleared.

DIM -12V State of Health
This is OK if the −12 volt supply in the DIM has stayed within 200 mV of −12 volts since the last time the SOH was cleared.

DIM -24V State of Health
This is OK if the −24 volt supply in the DIM has stayed within 200 mV of −24 volts since the last time the SOH was cleared.

Temperature State of Health
This is OK if the detector temperature has stayed below the high temperature limit set in the detector since the last time the SOH was cleared. This is available only for SMART-1 detectors.

High Voltage State of Health
This is OK if the HV supply in the DIM has stayed within 200 V of specified bias voltage since the last time the SOH was cleared.

Shutdown State of Health
This is OK if the detector shutdown has not activated since the last time the SOH was cleared.

Preamplifier overload State of Health

This is OK if the preamplifier overload has not activated since the last time the SOH was cleared.

Security State of Health

This is OK if the security test was passed at the end of the last spectrum acquisition. This is available only for SMART-1 detectors.

Power State of Health

This is OK if the power to the DIM was constant during the last spectrum acquisition.

+24 volts

This is the current value of the +24 volt supply in the DIM as delivered to the detector.

+12 volts

This is the current value of the +12 volt supply in the DIM as delivered to the detector.

−12 volts

This is the current value of the −12 volt supply in the DIM as delivered to the detector.

−24 volts

This is the current value of the −24 volt supply in the DIM as delivered to the detector.

High Voltage

This is the current value of the high-voltage bias supply in the DIM as delivered to the detector.

Detector temperature

This is the detector temperature at the time the current spectrum acquisition stopped. This is available only for SMART-1 detectors.

Live detector temperature

This is the detector temperature at the current time. This is available only for SMART-1 detectors.

Battery voltage

This is the present voltage of the internal battery.

Battery % full

This is an estimate of the amount of power remaining in the battery.

Battery time remaining

This is an estimate of the time remaining when using the internal battery and the digiDART operating in the present mode.

Presets

Figure 64 shows the Presets tab. MDA presets are shown on a separate tab.

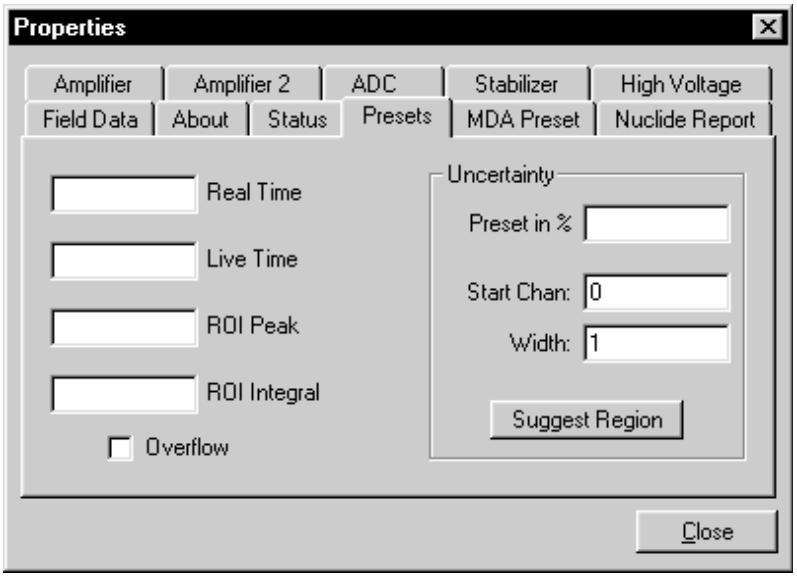


Fig. 64. digiDART Presets Tab.

The presets can only be set on an MCB that is *not* acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 4.3.4. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds 2^{31}-1 (over 2×10^{9}) counts.

MDA Preset

The MDA preset (Fig. 65) can monitor up to 20 nuclides at one time, and stops data collection when the minimum detectable activity for each of the user-specified MDA nuclides reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the “Analysis Methods” chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a+\sqrt{b+c*Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

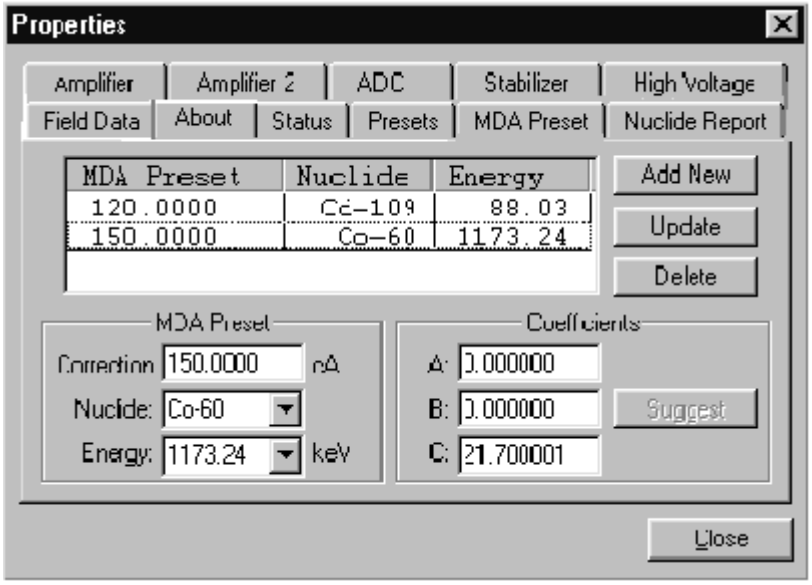


Fig. 65. digiDART MDA Preset Tab.

If the application supports efficiency calibration and the digiDART is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

Nuclide Report

Figure 66 shows the Nuclide Report tab. The Nuclide Report displays the activity of up to 9 user-selected peaks. Once the report is set up you can view the Nuclide Report at any time on the digiDART display. The peak area calculations in the hardware use the same methods as the MAESTRO **Peak Info** calculation described in Section 4.3.4, so the Nuclide Report display is the same as the **Peak Info** display on the selected peak in the spectra stored in the PC. The calculated value is computed by multiplying the net peak count rate by a user-defined constant.

If the constant includes the efficiency and branching ratio, the displayed value is the activity. You enter the nuclide label and the activity units.

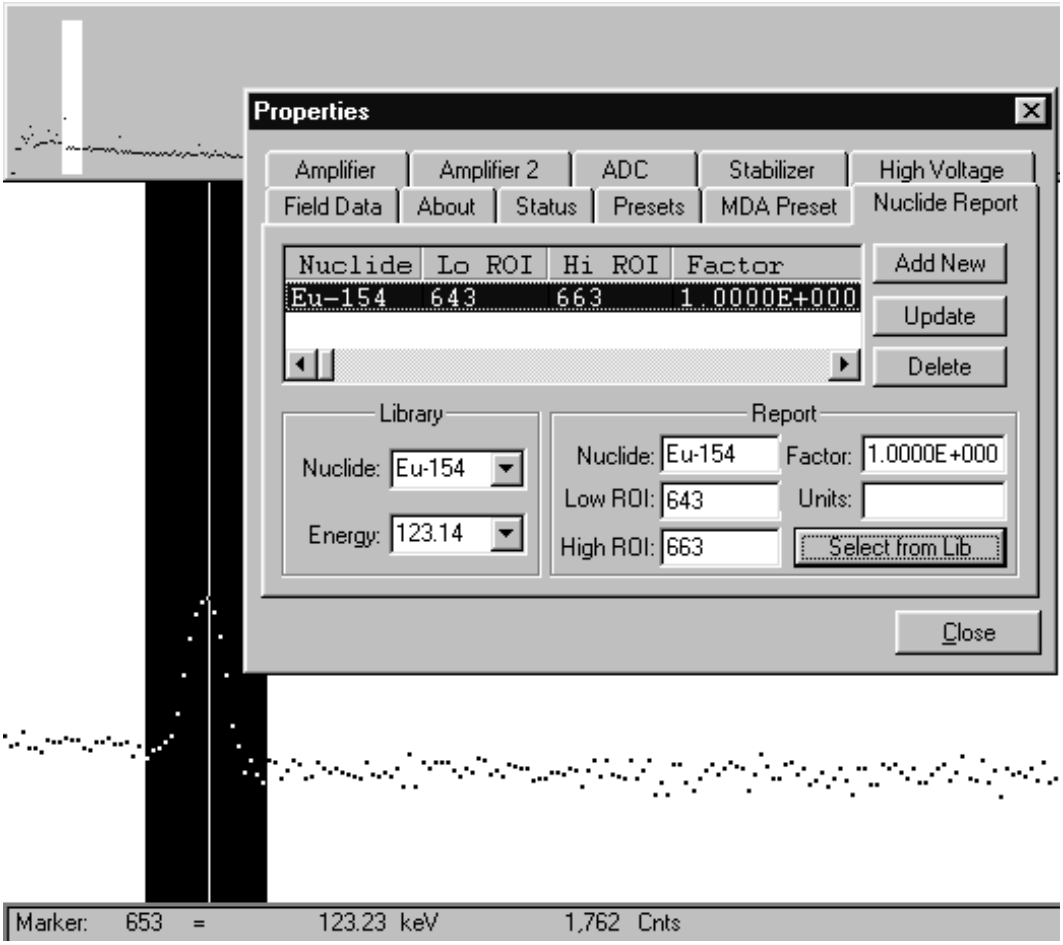


Fig. 66. Nuclide Report Setup Tab.

The report has this format:

Nuclide	keV	uCi/m2	±%
CO-60	1332.5	1.21E+01	10.2
CO-60	1173.2	1.09E+01	12.3
CO-57	122.1	1.48E+00	86.2

Calculations

These are the calculations used to generate the **Activity**, **Uncertainty**, and **Peak** values for the Nuclide Report.

1. Activity

Activity is calculated as follows:

$$Activity = \frac{NetCounts \cdot NucCoef}{LiveTime}$$

where:

NucCoef is normally the inverse of the product of the efficiency and the branching ratio. Note that the efficiency is the absolute counting efficiency for the source-detector geometry being used. Thus, in order to get meaningful activity results, as in any counting situation, you need to have efficiency factors which are appropriate to the actual counting geometry. If *NucCoef* is set to 1, you will get peak count rate on the display.

LiveTime is the current live time.

NetCounts is computed with the following equation:

$$NetCounts = GrossCounts - Background$$

GrossCounts is the sum of the counts in the ROI, excluding the first and last 3 channels of the ROI.

Background is:

$$Background = \frac{AvgCount\ first\ 3\ chan + AvgCount\ last\ 3\ chan}{2} \cdot ROIWidth$$

ROIWidth is:

$$ROIWidth = EndChannel - StartChannel + 1 - 6$$

2. Uncertainty

Uncertainty (in percent) is calculated as follows:

$$Uncertainty = \frac{\sqrt{GrossCounts + Background \cdot \frac{ROIWidth}{6}}}{NetCounts} * 100$$

3. Peak

Peak is the position of the maximum count and is computed with the following equation:

$$Peak = MaximumROIChan * EnergySlope + EnergyIntercept$$

where:

MaximumROIChan is the channel in the ROI with the most counts. If there are no data, the center channel of the ROI is used.

EnergySlope and *EnergyIntercept* are the energy calibration values as entered on the digiDART keypad or by software. If the values are not present, the result is given in channels.

Add New

Manual Add — Nuclides can be added to the list using the library to assist in the region definition or manually. To add a nuclide manually, enter the nuclide name, ROI start and end channels, multiplicative factor and units in the Report section. Now press **Add New** to add this nuclide to the list. The units need only be entered once, since they are the same for all nuclides in the table.

Library Add — To use the library to aid in the definition, select the nuclide from the library nuclide drop down list. Now select the gamma-ray energy from the Energy drop down list. This defines what gamma ray to use. Now Press the **Select from Lib** button in the Report section. This will update all the entries in this section and show (as a yellow band) the region

to be used in both the expanded spectrum and the full window. Now click on **Add New** to add this nuclide to the list.

Edit

To change any of the current nuclides, select the nuclide in the list (use the scroll bars if needed). This will show the current settings for this nuclide. Make any changes needed. Any or all of the entries can be changed. When finished with the changes, click on **Update**.

Delete

To remove an entry, select the entry and press **Delete**.

When you close the Properties dialog, all the values entered are written to the digiDART and are used when you view the Nuclide Report on the digiDART display.

4.2.7.3. InSight Mode

The **InSight** display (Fig. 67) shows the actual sampled waveform in the digital processing units on a reference graticule. The Properties dialog remains active and can be used to change settings while viewing the pulses. As none of the traditional analog signals are available in digital MCBs, this mode is the only way to display the equivalent amplifier output pulse. Note that at the bottom of the window the marker channel is displayed in units of time.

Exiting InSight Mode

To exit the InSight mode and return to the PHA display, press **<Esc>** or go to the **Insight** section on the Amplifier 2 tab and click on **Stop**. The PHA mode is set to STOP when in the InSight mode.

InSight Mode Controls

The Status Sidebar changes from the PHA mode controls to the InSight controls for adjusting the peak display (Fig. 67) On the left is a vertical scrollbar for adjusting the vertical offset of the waveform. The value of the offset is shown on the display. Double-clicking the mouse in the scrollbar will set the vertical offset to the vertical value of the channel at the marker position. This is to conveniently zoom in on a particular part of the waveform (such as the tail for pole-zeroing).

In the **Auto** trigger mode, the display is updated every time a new pulse exceeds the trigger level. To keep a single pulse displayed, select **Single**. Click on **Reset** to refresh the display to see the next pulse. There will usually be one or two pulses in the “pipeline” that will be displayed

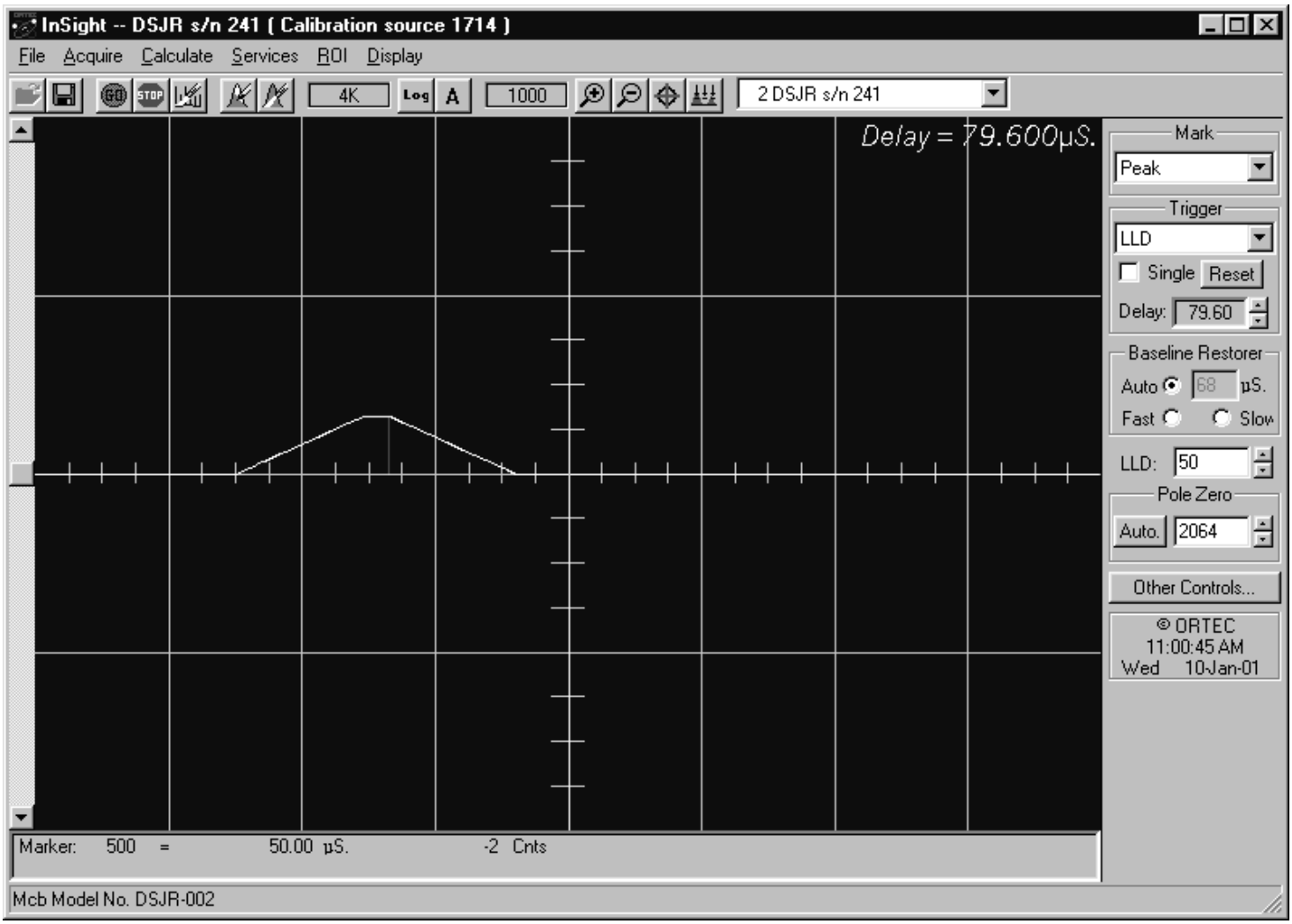


Fig. 67. The InSight Mode Display.

before any change entered will be seen. If the trigger is turned off, the display will be redrawn periodically, even if no pulse is there.

The **Delay** setting is the time delay between the pulse shown on the display and the trigger level crossing. The value of the time delay is shown on the display.

Just as for the PHA mode display, the vertical scale can be adjusted with the vertical adjustments. The display can be set to **Log** mode, but the peak shapes do not have a familiar shape in this display. The **Auto** mode will adjust the vertical scale for each pulse. The pulse is shown before the amplifier gain has been applied, so the relation between channel number and pulse height is not fixed.

The horizontal scale extends from 16 to 256 channels. The display is expanded around the marker position which means that in some cases the peak will disappear from the display when it is expanded.

The display can be switched from the current MCB to another Detector or the buffer. The other Detector will be shown in its most recent mode (PHA or InSight). The buffer will always be shown in PHA mode. When you return to the current MCB, the display will return to the InSight mode. This also holds true if you exit MAESTRO while in InSight mode; on next startup, this MCB will still be in InSight mode.

The display can include a **Mark** to indicate one of the other signals shown in Fig. 68. The Mark is a solid-color region displayed similarly to that of an ROI in the spectrum. This Mark can be used to set the timing for the gate pulse. It can also be used to set the shaping times and flattop parameters to get the best performance.

Fig. 68. Mark Display Selection.

For example, suppose it is necessary to get the best resolution at the highest throughput possible. By viewing the pulses and the pileup reject marker, the rise time can be increased or decreased to obtain a minimum of pileup reject pulses.

Mark Types

For the **Mark,** choose either "points" or "filled" (to the zero line) display. This is controlled by the selection in the **Display/Preferences** menu item. That choice does not affect the PHA mode choice. The colors are the same as for the PHA mode. (Not all DSP MCBs support all marks.)

None No channels are marked in the display.

PileUpReject The region marked indicates when the PUR circuit has detected pileup and is rejecting the marked pulses.

NegBLDisc This shows when the negative baseline discriminator has been triggered. Typically this signal only marks the TRP reset pulse. The signal is used internally in the live-time correction, baseline restoration, and pile-up rejection circuits.

BaseLineR This shows when the baseline restorer is actively restoring the baseline.

PosBLDisc This shows when the positive baseline discriminator has been triggered. The signal is used internally in the live-time correction, baseline restoration, and pile-up rejection circuits.

Busy When the busy signal is active, **Busy** shows in the **Mark** box. It represents the dead time.

Gate This shows when the gate signal is present on the gate input connector. If the **Gate** mode on the ADC tab (see Fig. 67) is set to **Off**, then all regions are marked. If the mode is set to **Coincidence**, then the marked region must overlap the pulse peak (that is, must start before the beginning of the flattop and stop after the end of the flattop) for the pulse to be counted. If the mode is set to **Anticoincidence**, then the marked region will show the pulses that are accepted. That is, the rejected peaks will not be marked. Simply put, in all modes the accepted peaks are marked.

Peak This is the peak detect pulse. It indicates when the peak detect circuit has detected a valid pulse. The Mark occurs about 1.5 μs after the pulse maximum on the display.

On the lower right of the InSight display are the shaping parameter controls. The controls are split into two groups, and the **other controls...** button switches between them. (Not all DSP MCBs support all of the controls.)

One group includes **Rise Time**, **Flattop**, **Tilt**, and the **Optimize** button. The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 μs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, **Optimize** can set the tilt value automatically. This value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The **Optimize** button also automatically adjusts the pole-zero setting.

4.2.7.4. Gain Stabilization

You can control the gain stabilizer on Detectors so equipped. The gain stabilizer requires a peak in the spectrum to monitor the changes in the gain of the system amplifier. The gain stabilizer controls the amplification factor of a separate amplifier so that the peak will be maintained in its original position. The input pulse-height-to-channel-number relationship is:

$$Channel\ number = Intercept + Gain * pulse\ height$$

where:

Intercept = The channel number of the zero-height input pulse
Gain = The relation between pulse height and channel number (slope of the curve)

Changes in either the intercept or gain can affect the positions of all the peaks in the spectrum. When used with the zero stabilizer, both the zero intercept and the gain (slope) will be monitored to keep all the peaks in the spectrum stabilized. The zero stabilization and gain stabilization are separate functions in the MCB, but both will affect the position of the peaks in the spectrum.

The stabilization operates by keeping a peak centered in an ROI you have defined. The ROI should be made symmetrically about the center of a peak with reasonably good count rate in the higher channels of the spectrum. The ROI should be about twice the FWHM of the peak. If the region is too large, counts not in the peak will have an effect on the stabilization. The ROI can be cleared after the **Peak** command so that peak count preset can be used on another peak.

The coarse and fine gains should be set to the desired values, both stabilizers initialized, and the pole zero triggered before setting either stabilization peak. For example, on the 92X this is done with the **Acquire/MCB Properties...** dialog; on the Model 919 it is done externally.

The **Initialize** dialog button sets the gain on the stabilization amplifier to its midpoint (that is, halfway between minimum gain and maximum gain). This should be done before selecting the ROI for the peak because the initialization might move the peak in the spectrum, and because it ensures that the maximum range is available for the stabilization process. If the peak is moved by this command, use the amplifier fine gain control (**<Alt + –>** or **<Alt + +>**) to move the peak to the desired channel.

When starting a new system, the zero-initialize command should also be given before starting the gain stabilization.

The **Suggest** button is used to set the peak center and peak width of the peak area used by the stabilizer. Before selecting this command, the ROI must be marked and the marker put in the region to be used. When operating, the peak will be centered in the ROI. After the region has been recorded, the stabilization is turned on. If the stabilization is turned on when this command is executed, the old stabilization region is replaced by the new peak defined by the marker, and stabilization continues using the new peak.

The **Gain Stabilizer Enabled** checkbox enables or disables the gain stabilization. It can only be turned on after the **Suggest** button has been used to select a working peak.

4.2.7.5. Zero Stabilization

The **Zero Stabilizer** function enables you to control the zero-level (or offset) stabilizer on Detectors so equipped. The zero-level stabilizer uses a peak in the spectrum to monitor the changes in the zero level of the system amplifier. The zero stabilizer controls the offset bias level so the peak will be maintained in its original position. The input pulse-height-to-channel-number relationship is:

$$Channel\ number = Intercept + Gain * pulse\ height$$

where:

Intercept = The channel number of the zero-height input pulse
Gain = The relation between pulse height and channel number (slope of the curve)

Changes in either the zero intercept or gain can affect the positions of all the peaks in the spectrum. When used with the gain stabilizer, both the zero intercept and the gain (slope) are monitored to keep all the peaks in the spectrum stabilized. The zero stabilization and gain stabilization are separate functions in the MCB but both will affect the position of the peaks in the spectrum.

The stabilization operates by keeping a peak centered in an ROI you have defined. The ROI should be set symmetrically about the center of a peak with reasonably good count rate in the lower channels of the spectrum. The ROI should be about twice the FWHM of the peak. If the region is too large, counts not in the peak will have an effect on the stabilization. The ROI can be cleared after the PEAK command so that peak count preset can be used on another peak.

The zero stabilization dialog **Initialize** button sets the zero offset to its midpoint (that is, halfway between minimum offset and maximum offset). This should be done before selecting the ROI for the peak because the initialization might move the peak in the spectrum, and because it ensures that the maximum range is available for the stabilization process.

The **Suggest** button is used to set the peak center and peak width of the peak area used by the stabilizer. Before selecting this command, the ROI must be marked and the marker put in the region to be used. When operating, the peak will be centered in the ROI. After the region has been recorded, the stabilization is turned on. If the stabilization is turned on when this command is executed, the old stabilization region is replaced by the new peak defined by the marker, and stabilization continues using the new peak.

The **Zero Stabilizer Enabled** checkbox enables or disables the zero stabilization. It can only be turned on after the **Suggest** button has been used to select a working peak.

4.2.7.6. ZDT (Zero Dead Time) Mode

An extended live-time clock increases the collection time (real time) of the acquisition to correct for input pulse train losses incurred during acquisition due to system dead time. This corrected time value, known as the "live time," is then used to determine the net peak count rates necessary to determine nuclide activities. As an example, consider the case where the spectrometry amplifier and ADC are 25% dead during the acquisition. If a live-time preset of 100 seconds is selected, the spectrometer counts for a total of 133.33 seconds (real time). The extra 33.33 seconds make up for the gamma rays lost due to system-busy time. The total counts in a peak can then be divided by 100 to determine the number of gamma rays per second recorded in the spectrum.

Unfortunately, extending the counting time to make up for losses due to system-busy results in an incorrect result *if the gamma-ray flux is changing as a function of time*. If an isotope with a very short half-life is placed in front of the detector, the spectrometer might start out with a very high dead time, but the isotope will decay during the count and the dead time will be zero by the end of the count. If the spectrometer extends the counting time to make up for the lost counts, it will no longer be counting the same source as when the losses occurred. As a result, the number of counts in the peak will not be correct.

When the DSPEC Plus operates in ZDT[4] mode, it adjusts for the dead-time losses by taking very short acquisitions and applying a correction in ***real time*** — that is, as the data are coming in — to the number of counts in the spectrum. This technique allows the gamma-ray flux to change while the acquisition is in progress, yet the total counts recorded in each of the peaks are correct. The resulting spectrum has no dead time at all — in ZDT mode, the *data* are corrected, not the acquisition time. Thus, the net counts in a peak are divided by the real time to determine the count rate.

ZDT mode has a unique feature in that it can store both the corrected spectrum and the uncorrected spectrum, or the corrected spectrum and the uncertainty spectrum.

The uncorrected spectrum (also called the live-time-corrected [LTC] spectrum) can be used to determine exactly how many pulses at any energy were processed by the spectrometer. The corrected spectrum gives the best estimate of the total counts that would have been in the peak if the system were free of dead-time effects. The uncertainty spectrum can be used to calculate the counting uncertainty, channel by channel, in the corrected spectrum.

NOTE When the spectrometer is placed in ZDT mode, the throughput of the instrument is reduced somewhat as extra processing must be done on the spectrum; therefore, if the

gamma-ray flux is not changing as a function of time, but absolute highest throughput is desirable, you might wish to store only the LTC spectrum in the DSPEC Plus memory.

When ZDT counting is enabled (in mode 0; **ZDT Mode** field set to **NORM_CORR** on the ADC tab), the two spectra stored are the LTC spectrum (live time and real time with dead-time losses) and the spectrum corrected for the dead-time losses (real time only). Unfortunately, in the analysis of the ZDT spectrum, the uncertainty of the measurement cannot be determined using either spectrum.

In the second ZDT mode (**ZDT Mode** field set to **CORR_ERR** on the ADC tab), the estimation of the statistical uncertainty is stored in place of the LTC spectrum, and is referred to as the *error spectrum* (ERR). In this mode, the corrected spectrum is used to measure the counts in a peak, and the error spectrum is used to determine the uncertainty of the measurement made in the corrected spectrum. Table 1 shows which spectra are collected in the three possible DSPEC Plus modes.

For example, if the area of a peak is measured in the corrected spectrum by summing channels 1000 to 1100, the variance of the measurement can be determined by summing the counts in channels 1000 to 1100 in the error spectrum. Or, shown another way, the counts in channel i can be expressed as $N(i) \pm \sqrt{V(i)}$ with a 1-sigma confidence limit, where N is the corrected spectral data and V is the variance (error) spectral data.

Table 1. DSPEC Plus ZDT Modes.

Mode	Uncorrected Spectrum	ZDT Corrected Spectrum	ZDT Error Spectrum
ZDT Disabled	Yes	No	No
ZDT–LTC Mode	Yes	Yes	No
ZDT–ERR Mode	No	Yes	Yes

4.2.7.7. Setting the Rise Time in Digital MCBs

To achieve the best results for your application, when using a digital spectrometer, such as the DSPEC Pro, DSPEC jr 2.0, digiDART, DSPEC Plus, or DSPEC, we recommend that you set the rise time of the pulses being processed by the digital filter to the minimum value for the resolution needed.

The pulse rise time (and also fall time) is based on the time required for each pulse to reach its peak value. This “peaking time” is about twice that indicated by the conventional time constants displayed on the front panel of commercial analog amplifiers. For example, germanium detectors

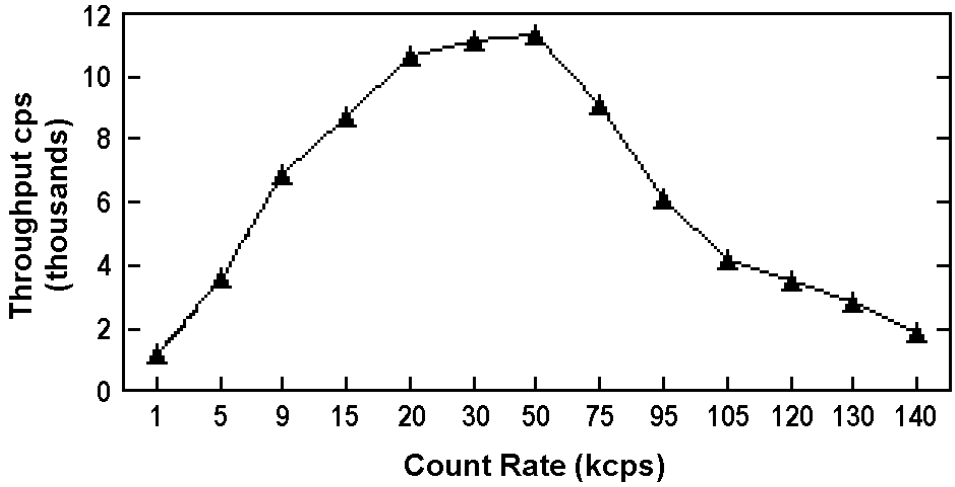


Fig. 69. An Example of the Tradeoff Between Throughput and Count Rate.

are often specified at a 6-µs time constant; this setting is equivalent to 12-µs peaking (rise) time in our digital spectrometers.

Up to some value of rise time, one can expect improved resolution with increasing rise time; there will, however, be a tradeoff in maximum throughput to memory. Figure 69 illustrates an example of this tradeoff. ORTEC digital spectrometers operate well above the peak of the throughput curve. Operating there allows these instruments to handle an even higher rate of incoming counts, but with less data into memory and, therefore, longer counting time to the same detection limit. It is possible to move the peak of the curve to the right (more counts to memory with higher input count rate) by reducing the pulse rise (and fall) time, thereby trading off resolution for maximum count rate.

Table 2 is a guide to choosing a count rate that will ensure that the most efficient operation of your digital spectrometer over the range of anticipated input count rates for your application — that is, at or below the throughput peak — while achieving the best resolution obtainable from the detector consistent with that requirement. Enter the rise time that best matches your dynamic range of count rate (note that the available rise-time settings will vary by instrument; this chart is a general guide only).

Table 2. Rise Time Selection Guide.

Input Count Rate Dynamic Range	Maximum Throughput	Rise Time (µs)
0--->20000	9000	12
0--->50000	12500	8
0--->75000	23500	4
0--->100000	37000	2.4
0--->150000	50000	1.6
0--->200k	70000	0.8
0--->220k	85000	0.6
0--->250k	100000	0.4
0--->300k	120000	0.2

The longest rise time shown in the table is 12 µs, even though some digital instruments can be set for rise times as long as 23 µs. If throughput is not an issue because all samples are low rate, increasing the rise time beyond 12 µs might achieve a small improvement in resolution. For planar detectors, such as ORTEC's GLP, Si(Li), IGLET, and IGLET-X Series, operating at longer rise times frequently gives improved resolution.

4.3. Calculate

The Calculate menu (Fig. 70) provides useful analytical tools for spectrum manipulation. **Smooth** and **Strip...** are only available in buffer mode. **Peak Info** and **Sum** are not available if the Detector is acquiring data.

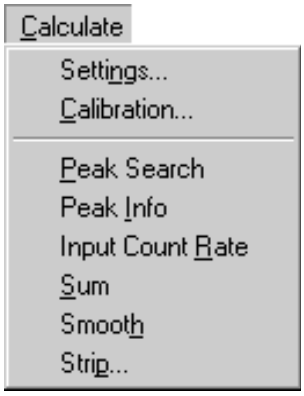


Fig. 70. Calculate Menu.

4.3.1. Settings...

This dialog, shown in Fig. 71, allows you to set the FW(1/x)M and the peak search sensitivity factor.

4.3.1.1. "x" for FW(1/x)M=

This is the x-factor used in the full-width-at-1/x-maximum calculation in the **Peak Info** calculation for the ROI peak marked by the cursor. This number is retained and used until changed. The dialog prompts you to enter the x-factor, which is an integer from 2 to 99. **Peak Info** always prints the FWHM, so an x of 2 is not needed.

4.3.1.2. Sensitivity Factor

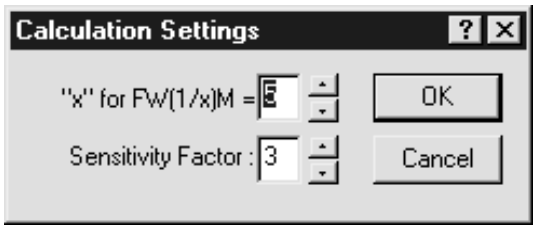


Fig. 71. The Calculation Settings Dialog.

Suspected peaks in a spectrum must pass a sensitivity test to be accepted. This test compares the magnitude of the second difference with the weighted error of the channel counts. If the second difference is greater than the weighted error, the peak is accepted. The **Sensitivity Factor** is a multiplicative factor in the weighting factor. This peak-search sensitivity can set from 1 to 5, with 1 being the most sensitive (that is, 1 finds the most peaks). A value of 1 will find small peaks, but will also find many false peaks. A value of 5 will locate all the big peaks, but might miss some of the smaller ones. The middle value of 3 is a good choice to start with.

Enter the integer value or use the up/down buttons to the right of the field. The current value is shown on the dialog.

4.3.2. Calibration...

4.3.2.1. General

The Calibrate dialog (Fig. 72) is used to establish a multi-point calibration for the data memory such that channel position and peak parameters are reported in the specified units as well as channels. If two points are entered, a linear calibration is done. When three or more points are entered, a quadratic fit to the entered points (up to 96 points) is automatically performed. The default units are keV but can be any units that you supply (as discussed in Section 4.3.2.2). The peak shape is measured and stored for later use in functions such as marking ROIs.

The calibration is stored with the spectrum when you use the Save command. The calibration values are also saved when the program is exited and are read when the program is started so that the calibration is automatically restored. Recalling a spectrum will also recall its associated calibration.

Detectors can be calibrated directly when they are not acquiring data. Each Detector and the buffer can have separate calibration values and units. Once a unit is calibrated, all *CONNECTIONS* programs on all PCs in the network use the same calibration.

Calibration... internally maintains a table of the entered points. As each new point is entered, a notation at the bottom of the spectrum window is displayed to indicate how many points have been entered in the table. The table is reset to zero entries whenever (1) the **Destroy Calibration** button is activated; or (2) another window is selected, in which case only the computed quadratic calibration coefficients are retained for the currently active display.

NOTE With this latter case in mind, you should be careful to perform the calibration in the Detector or the buffer with an uninterrupted series of points before switching to the other display; otherwise, the table will be cleared. Terminating and restarting the application will also clear the table.

When recalibrating a previously calibrated spectrum, such as after resetting the table as described in case (2) above, the old calibration is retained until after the second new point has been entered. This facilitates recalibration, since the previous calibration values can simply be adjusted rather than entered from scratch for the first two points. (Of course, if you want a complete new recalibration, you can click on the **Destroy Calibration** button.)

4.3.2.2. How to Calibrate

The calibration is done by first marking well-separated clean peaks with ROIs. The object is to supply the energies for these peaks. (This is not absolutely necessary, since if no ROI is present at the marker, the marker channel itself will be used. However, that is less accurate than using the ROI method.)

1. Place the marker on one of the peaks.

2. Press **<Insert>** to insert an ROI on the peak.

3. Select **Calculate/Calibration...** to choose the marked peak and calculate the centroid of the peak. If there is an ROI at the marker and the marked peak is good (that is, if it can be used in the calculation), the program will ask for the energy of the peak (see Fig. 72). If there is no ROI at the marker, a warning will appear at the bottom of the screen (see Fig. 73), and the marker channel will be used instead of the peak centroid.

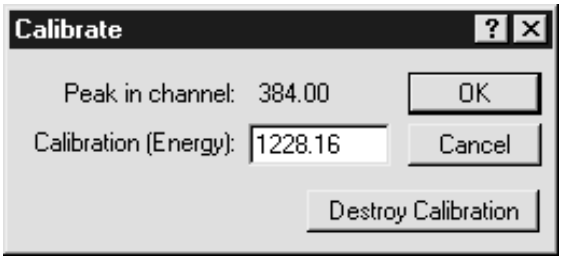


Fig. 72. The Calibrate Dialog.

4. Now move the marker to the second peak and repeat the process.

5. After the second peak value is entered, the program will ask for up to four characters for the units (see Fig. 74).

Marker: 758 = 758.00 keV 2,483 Cnts
No ROI found -- using single-channel calibration point.
Entering Calibration for point number 1...

Fig. 73. Calibration with No ROI.

The system is now calibrated and the marker location is shown in both channels and the input units. You might continue to add peaks (up to 96) for a better quadratic fit to the data. The fit is automatically redone after each point is entered.

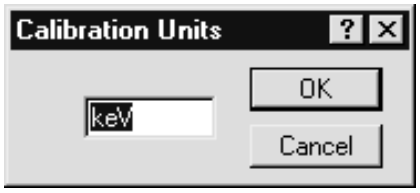


Fig. 74. Calibration Units Inputs.

4.3.3. Peak Search

This function initiates a Mariscotti[9]-type peak search on the spectrum in the Detector (when the Detector is not collecting data) or the buffer. The peak search sensitivity is selected in the **Settings...** item of this menu. Each peak found is marked as an ROI. If the system is calibrated, the width of the ROI is three times the calculated FWHM of the peak. If not calibrated, the width of the ROI is based on the width of the peak as determined by the peak search. Overlapping or close peaks might have contiguous ROIs. Existing ROIs are not cleared.

The **ROI Report** command (see Section 4.1.7) can be used with this function to produce a semi-quantitative nuclide list for the spectrum.

[9]M.A. Mariscotti, "A Method for Automatic Identification of Peaks in the Presence of Background and its Application to Spectrum Analysis," *Nuclear Instruments and Methods* **50**, 309–320 (1967).

4.3.4. Peak Info

This command displays one of the following for the marker in an ROI:

- If the spectrum is not calibrated, the channel centroid, FWHM, FW1/xM (all in channels), gross area, net area, and net-area uncertainty are displayed for the ROI peak marked by the marker.

- If the spectrum is calibrated, the channel centroid, FWHM, FW1/xM in channels and calibration units (e.g., energy), library "best match" energy and activity, gross area, net area, and net-area uncertainty are displayed for the ROI peak marked by the marker.

This information is displayed beneath the Spectrum Window on the Supplementary Information Line and/or in a text box inside the Expanded Spectrum View, at the top of the peak. Both displays are illustrated in Fig. 75. To remove the text, press **<Esc>**.

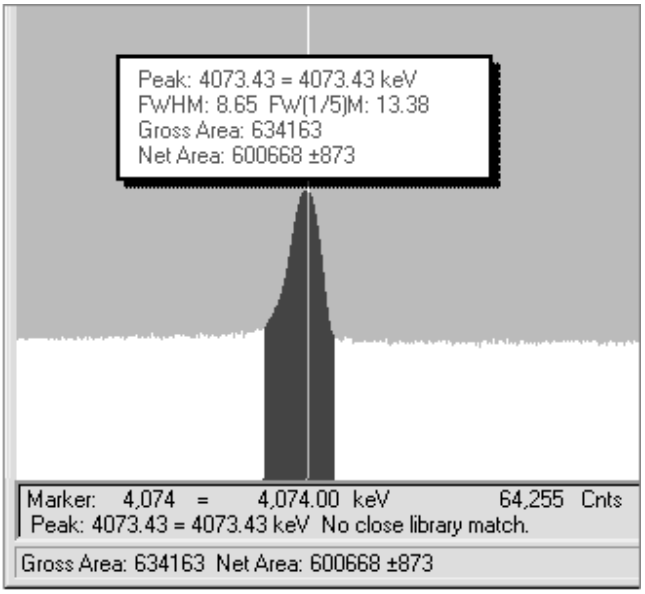

Peak: 4073.43 = 4073.43 keV
FWHM: 8.65 FW(1/5)M: 13.38
Gross Area: 634163
Net Area: 600668 ±873
Marker: 4,074 = 4,074.00 keV 64,255 Cnts
Peak: 4073.43 = 4073.43 keV No close library match.
Gross Area: 634163 Net Area: 600668 ±873

Fig. 75. Peak Info Beneath Marker and at Top of Peak.

The program subtracts the calculated background, channel by channel, and attempts a least-squares fit of a Gaussian function to the remaining data. If unsuccessful, it displays "Could Not Properly Fit Peak." If successful, the centroid is based on the fitted function. The reported widths are linearly interpolated between the background-subtracted channels.

The background on the low channel side of the peak is the average of the first three channels of the ROI (see Fig. 76).

The channel number for this background point is the middle channel of the three points. The background on the high channel side of the peak is the average of the last three channels of the ROI. The channel number for this background point is also the middle channel of the three points. These two points on each side of the peak form the end points of the straight-line background.

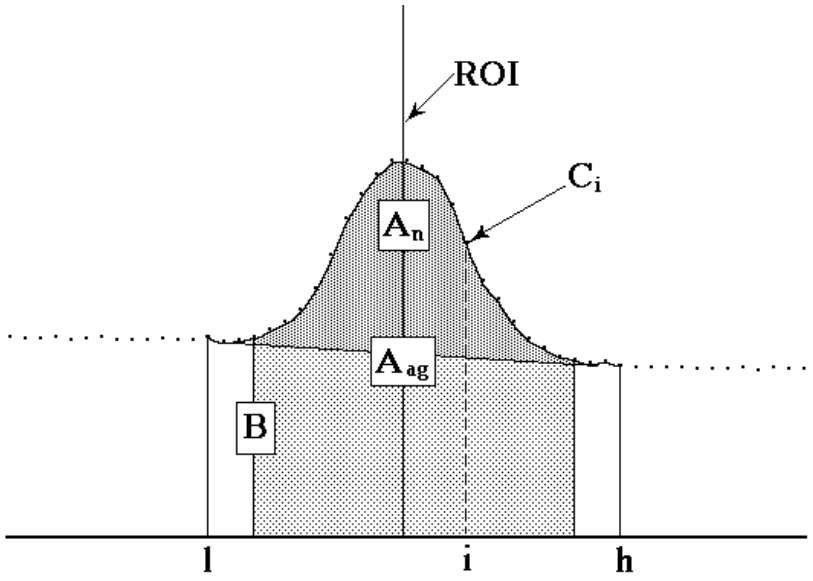


Fig. 76. Background Calculation Details.

The background is given by the following:

$$B = \left(\sum_{i=l}^{l+2} C_i + \sum_{i=h-2}^{h} C_i \right) \frac{h - l + 1}{6} \quad \textbf{(1)}$$

where:

B = the background area
l = the ROI low limit
h = the ROI high limit
C_i = the contents of channel i
6 = the number of data channels used (three on each end)

The gross area is the sum of all the channels marked by the ROI according to the following:

$$A_g = \sum_{i=l}^{h} C_i \quad \textbf{(2)}$$

where:

A_g = the gross counts in the ROI
l = the ROI low limit
h = the ROI high limit
C_i = the contents of channel i

The adjusted gross area is the sum of all the channels marked by the ROI but not used in the background according to the following:

$$A_{ag} = \sum_{i=l+3}^{h-3} C_i \qquad \textbf{(3)}$$

where:

A_{ag} = the adjusted gross counts in the ROI
l = the ROI low limit
h = the ROI high limit
C_i = the contents of channel i

The net area is the adjusted gross area minus the adjusted calculated background, as follows:

$$A_n = A_{ag} - \frac{B\,(h - l - 5)}{(h - l + 1)} \qquad \textbf{(4)}$$

The uncertainty in the net area is the square root of the sum of the squares of the uncertainty in the adjusted gross area and the weighted error of the adjusted background. The background uncertainty is weighted by the ratio of the adjusted peak width to the number of channels used to calculate the adjusted background. Therefore, net peak-area uncertainty is given by:

$$\sigma_{An} = \sqrt{A_{ag} + B\left(\frac{h - l - 5}{6}\right)\left(\frac{h - l - 5}{h - l + 1}\right)} \qquad \textbf{(5)}$$

where:

A_{ag} = the adjusted gross area
A_n = the net area
B = the background area
l = the ROI low limit
h = the ROI high limit

4.3.5. Input Count Rate

This command is supported by most modern MCBs (the menu item is gray/inactive for unsupported units), and displays or hides the input count rate indicator (Fig. 77) in the upper left corner of the spectrum window (this is the input count rate, not the number of processed pulses). Note that if the full

Fig. 77. Input Count Rate Display in Expanded Spectrum View.

spectrum view is positioned in the same corner, it can obscure the Input Count Rate box. This command is also on the right-mouse-button menu.

4.3.6. Sum

The **Sum** function performs its calculation in one of two ways, depending on the position of the marker:

1. If the marker is not in an ROI, the sum of the data channels in the buffer is shown on the display. The complete channel width (e.g., 1 to 16384) is summed.

2. If the marker is in an ROI, the sum of the data channels in the ROI is shown on the display. This is the same as the gross counts in the Peak Info display, but can be used on wider ROIs.

4.3.7. Smooth

The **Smooth** command is available in buffer windows only. It transforms the data in the buffer according to a five-point, area-preserving, binomial smoothing algorithm; that is, the existing data is replaced, channel-by-channel, with the averaged or smoothed data as follows:

$$S_i = \frac{(O_{i-2} + 4O_{i-1} + 6O_i + 4O_{i+1} + O_{i+2})}{16} \quad \textbf{(6)}$$

where:

S_i = the smoothed data in channel i
O_i = the original data in channel i

4.3.8. Strip...

This command (Fig. 78) strips the specified disk spectrum from the spectrum in the buffer and stores the result in the buffer. Select a **File name** and **Stripping Factor**, and click on **OK**.

NOTE Any valid spectral data file can be selected, but it must contain the same number of channels as the buffer.

The strip factor is a real number that is multiplied, channel by channel, by the disk spectrum before being subtracted from the buffer. If the **Use Ratio of Live Times** box is marked, the strip factor is calculated as the ratio of the live time of the buffer spectrum divided by the live time of the disk spectrum. Unmarking the **Use Ratio** box allows you to enter a factor, which can be negative, in which case the spectra are added.

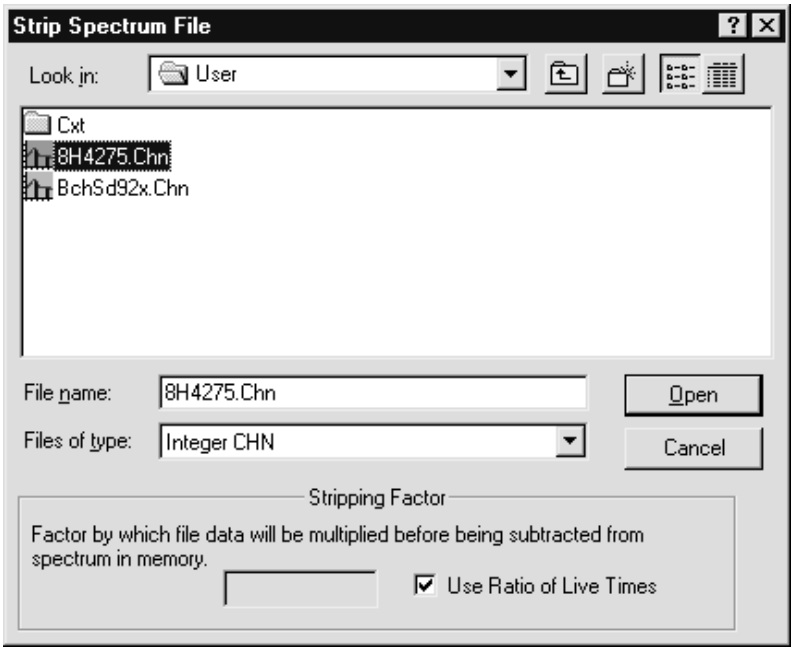


Fig. 78. The Strip Spectrum File Dialog.

NOTE The live times and real times are not changed by any strip operation. The peak uncertainty does not include the stripped areas and might not represent the true uncertainty.

4.4. Services

The Services menu (Fig. 79) contains several functions and utilities.

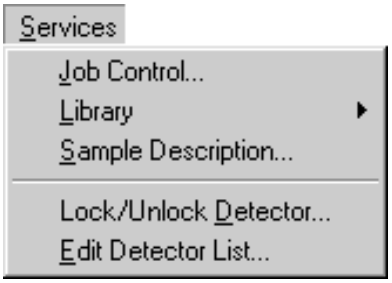


Fig. 79. The Services Menu.

4.4.1. Job Control...

Most of the functions under the various MAESTRO menus can be automated by writing a *JOB*, which consists of one or more commands written in ASCII text (see Chapter 6 for an in-depth discussion). JOBs allow you to easily perform repetitive tasks and/or define initial conditions at Detector startup. These files are given a filename extension of `.JOB`. To start a JOB or edit a `.JOB` file, select **Services/Job Control...** to display the dialog shown in Fig. 80.

To run a JOB, select a `.JOB` filename and click on **Open**. The contents of the selected file can be displayed at the bottom of the dialog by using the mouse to mark the **Show Contents** checkbox.

Note that displaying the file contents will slow down the accessing of files, especially when browsing through a long list.

Once a JOB is started, most menu functions will be disabled (grayed) to prevent interference with JOB as it runs. The **.JOB** filename will be displayed on the Title Bar.

If you try to start another JOB while a JOB is already running, the dialog shown in Fig. 81 will open, showing the name of the current JOB. In this case, the options available are to terminate execution of the running JOB (click on **Terminate Job**) or allow the JOB to continue (click on **Close** or press **<Esc>**).

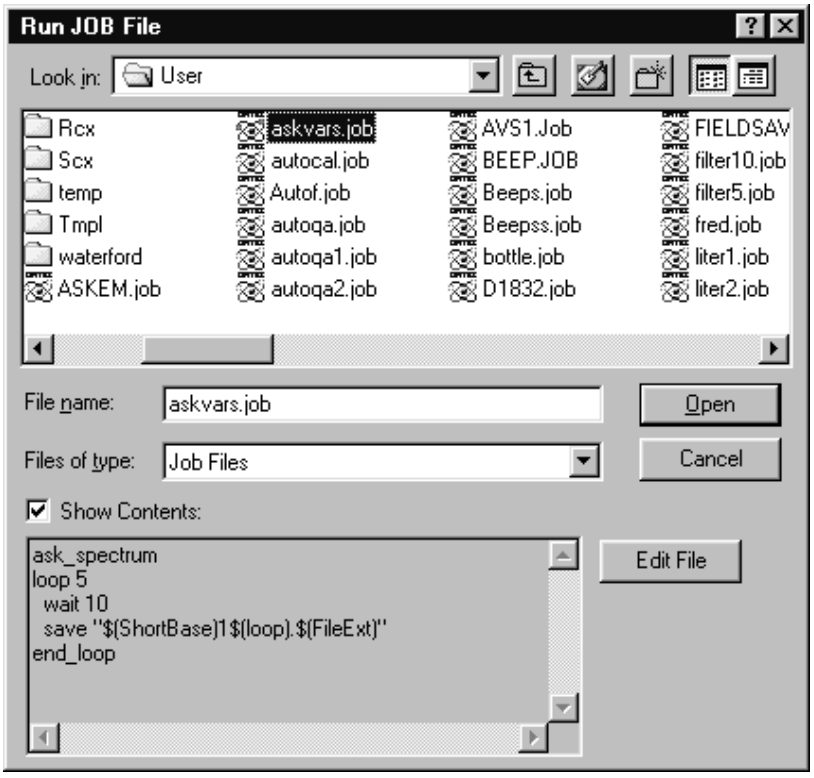


Fig. 80. .JOB File Selection and Execution.

To edit a **.JOB** file from the Run JOB File dialog (whether or not **Show Contents** is activated), select a file from the list and click on the **Edit File** button. This will open Windows Notepad with the **.JOB** file loaded.

NOTE When editing is complete, the file *must* be saved in Notepad (select **Save** or **Save As** under the **File** menu) for the changes to be effective. When Notepad is closed (**File/Exit**), the newly edited file will be shown in the Run JOB File dialog's **Show Contents** list box.

Fig. 81. Dialog if JOB is Already Running.

If a JOB is terminated prematurely because of some error condition, a message box briefly explaining the cause of the error will be displayed. More details on the error can be found by cross-referencing with the error message directory in Appendix C.

4.4.2. Library

The commands on this submenu (Fig. 82) allow you to select the nuclide library to be used and display the peaks list. MAESTRO V6 uses the GammaVision Library Editor (supplied; see Section 7.2 for a detailed discussion), so you can now use **.LIB**- or **.MDB**-type (NuclideNavigator) libraries.[10]

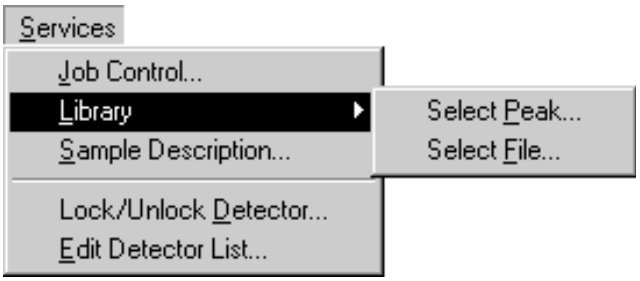
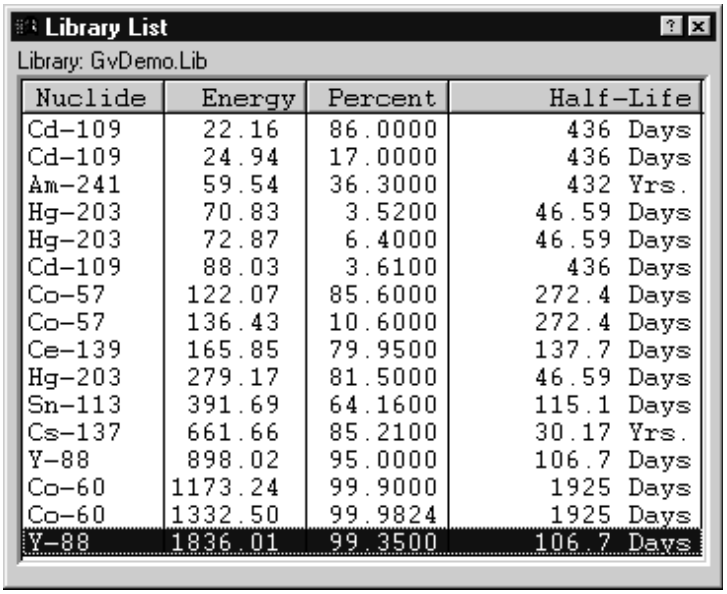


Fig. 82. The Library Submenu.

4.4.2.1. Select Peak...

This opens a window containing a list of the library peaks in energy order (Fig. 83). This list shows the nuclide name, energy, gammas/100 disintegrations, and half life. Clicking on any field moves the marker line to that energy in the spectrum.

The Library List can be sorted by nuclide, energy, percent, or half-life by clicking on the desired column header.



Nuclide	Energy	Percent	Half-Life
Cd-109	22.16	86.0000	436 Days
Cd-109	24.94	17.0000	436 Days
Am-241	59.54	36.3000	432 Yrs.
Hg-203	70.83	3.5200	46.59 Days
Hg-203	72.87	6.4000	46.59 Days
Cd-109	88.03	3.6100	436 Days
Co-57	122.07	85.6000	272.4 Days
Co-57	136.43	10.6000	272.4 Days
Ce-139	165.85	79.9500	137.7 Days
Hg-203	279.17	81.5000	46.59 Days
Sn-113	391.69	64.1600	115.1 Days
Cs-137	661.66	85.2100	30.17 Yrs.
Y-88	898.02	95.0000	106.7 Days
Co-60	1173.24	99.9000	1925 Days
Co-60	1332.50	99.9824	1925 Days
Y-88	1836.01	99.3500	106.7 Days

Fig. 83. Peak List Dialog Box.

4.4.2.2. Select File...

A *nuclide library* is used by the **Peak Search** and report functions for semi-quantitative identification and activity calculations for spectral components according to calibrated peak energy.

At startup, MAESTRO automatically attempts to load the library last loaded. This *working library* stays resident in memory after it has been loaded. Thereafter, it can be replaced at any time using the **Select File...** command, which displays the dialog shown

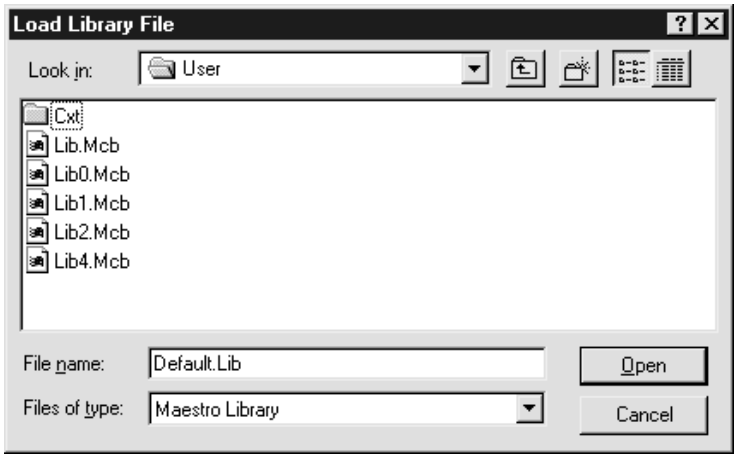


Fig. 84. The Load Library File Dialog.

[10]The old MAESTRO library format (.MCA) is no longer supported.

in Fig. 84. Either **.LIB**-type or **.MDB**-type libraries can be used. When a library is loaded, and if the spectrum is calibrated, the Library indexing buttons on the Status Sidebar are enabled (black).

4.4.3. Sample Description...

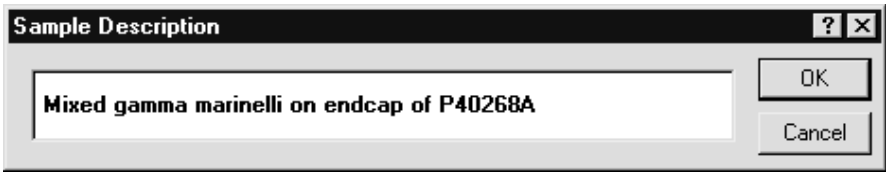


Fig. 85. Sample Description Entry.

This command opens the dialog shown in Fig. 85 for reading, editing, or entering the Sample Description of the displayed spectrum. This description can be up to 128 characters in length, and automatically accompanies the spectrum when it is subsequently copied or saved to a file. This description also appears in the title bar at the top of the window while the spectrum is displayed. For files in the **.CHN** format, only the first 63 characters are saved in the spectrum file.

4.4.4. Lock/Unlock Detector...

This facility enables you to protect a Detector from destructive access (e.g., **Start**, **Stop**, **Clear**) by any program on the PC or network. While any program can *view* the data and read the contents on any Detector in the system — locked or unlocked — the contents of a locked Detector cannot be changed without knowing the password.

NOTE ***There is no master password***. If the password is lost, contact ORTEC Customer Service for assistance in unlocking the detector.

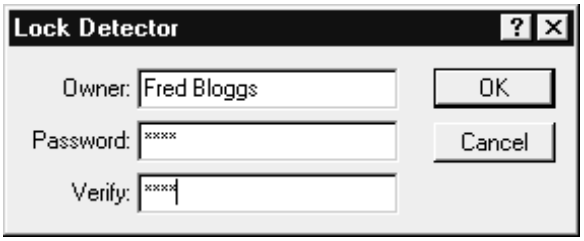


Fig. 86. Entering Name/Password to Lock a Detector.

If the Detector is currently unlocked, selecting **Lock/Unlock** will show the dialog displayed in Fig. 86. Enter the **Owner** name. Then enter a password in the **Password** field, and re-enter it in the **Verify** field (the two entries must agree). Click on **OK**. The password is not case-sensitive (that is, uppercase and lowercase letters are treated the same).

If the Detector is currently locked, selecting **Lock/Unlock** will display the dialog in Fig. 87. Enter the correct password to unlock the Detector.

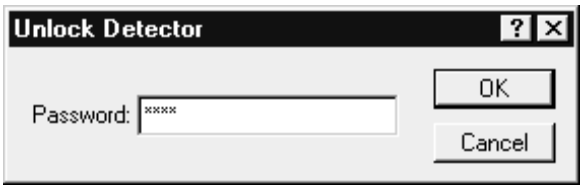


Fig. 87. Unlocking a Detector.

Each time destructive access to a Detector is attempted while it is locked, the **Locked Detector** dialog (see Fig. 88) will ask for the password. In addition, the owner of the Detector will be displayed on the Supplemental Information Line, as shown in Fig. 89.

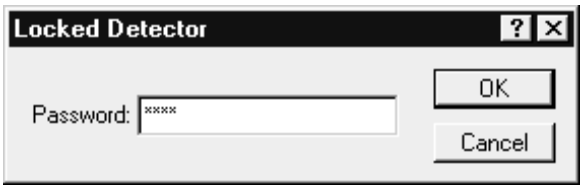


Fig. 88. Password for Accessing Locked Detector.

If you enter the incorrect password in either the **Unlock** or **Locked Detector** dialog, the dialog will reopen and wait for the correct password. If you do not know the password, click on **Cancel** to close the dialog (you will still have read-only access).

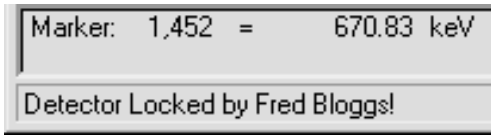


Fig. 89. Name of Person Who Locked Detector.

4.4.5. Edit Detector List...

This function allows you to select the Detectors that will be available to MAESTRO on this PC. Other applications (e.g., ScintiVision-32™, AlphaVision-32®, GammaVision) on the same PC can have their own lists. In this way, the different Detectors on the network can be segregated by function or type.

NOTE When you invoke this command, all Detector windows close without warning, all buffer windows close with a warning, and a buffer window opens. The buffer window remains open after you have closed the Detector List Editor dialog.

Figure 90 shows the Detector List Editor dialog. On the left is the **Master Detector List** of all Detectors on the system. This master list is created by the MCB Configuration program (which is discussed in detail in the MCB Properties manual) and is the same for all ORTEC programs (e.g., MAESTRO, GammaVision, ScintiVision) running on all PCs connected to the workgroup. The default description for each instrument is derived from the hardware and can be changed within the configuration program.

The MAESTRO **MCA Pick List** initially contains all of the instruments in the master list.

To add a Detector to the MAESTRO **Pick List** for this PC, click on the name in the Master list, then click on **Add**. To add all the Detectors on the **Master Detector List**, click on **All**.

To remove a Detector from this local pick list, click on the name in the **Pick List** and click on **Remove**. To remove all the Detectors, click on **New**.

When Detector selection is complete, click on **OK**. These selections will be saved to disk and used by MAESTRO until changed on this screen or until the entire network is reconfigured.

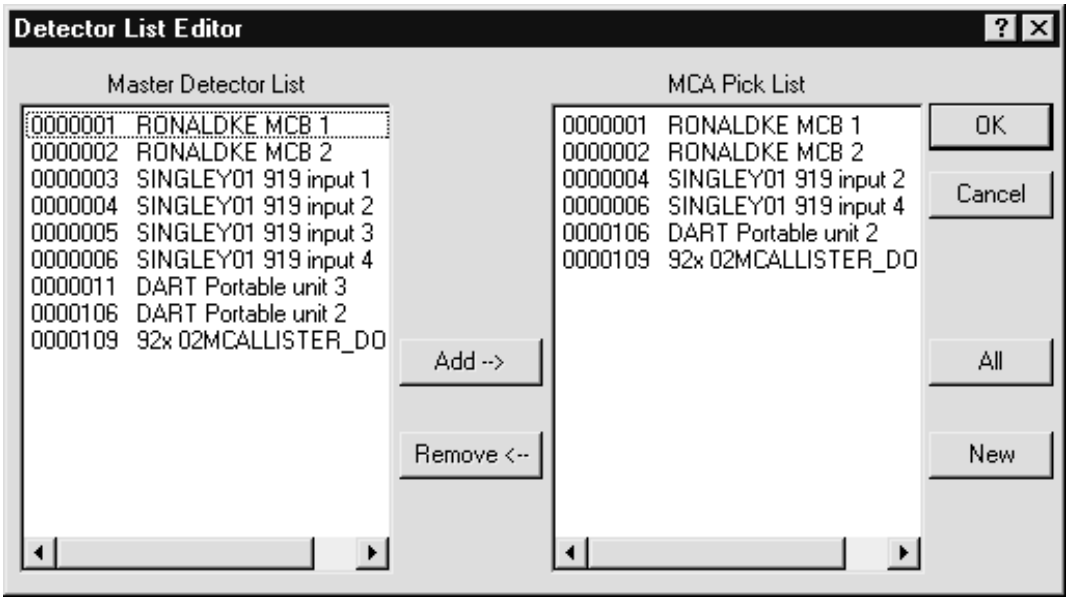


Fig. 90. Detector List Editor Dialog.

CONNECTIONS-32 programs such as MAESTRO can have more than one Detector pick list on the PC. For more information on creating and using alternate pick lists, see the **`listname`** discussion on page 157.

4.5. ROI

An ROI — *region of interest* — is a way to denote channels or groups of channels in the spectrum as having special meaning. An ROI can be used to mark peak areas for the printout or to mark a peak to stop acquisition when that peak reaches a preset value. Channels marked as ROI channels are displayed in a different color than the unmarked channels.

The **ROI** menu is shown in Fig. 91. Its functions are available in both buffer and Detector windows. See Section 3.5.3 for ROI operations performed with the mouse.

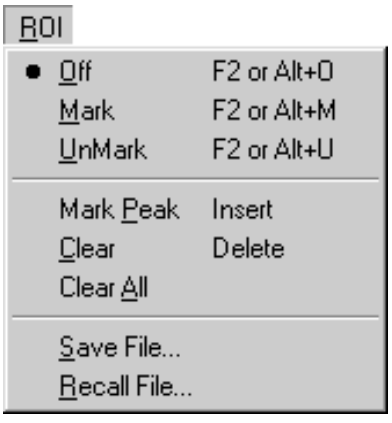


Fig. 91. ROI Menu.

4.5.1. Off

This sets the ROI status to Off. In this state, the ROI bit for the channels will not change as the cursor moves. This function is duplicated by **<Alt + O>** and by **<F2>** (which toggles between **Off**, **Mark**, and **UnMark**).

The usual ROI status is Off so the marker can be moved on the display without changing any of the ROI bits.

4.5.2. Mark

This sets the ROI status to the Mark or set condition. In this state, the cursor channels are marked with the ROI bit as the cursor is moved with <→> or <←> into the channel. Moving the marker with the mouse does not change the ROI in this mode. This function is duplicated **<Alt + M>** and by **<F2>** (which toggles between **Off**, **Mark**, and **UnMark**).

ROIs can also be marked with the rubber rectangle and right-mouse-button menu (see Sections 3.5.3 and 4.8.8), and as described in Section 4.5.4.

4.5.3. UnMark

This sets the ROI status to the unmark or reset condition. In this state, the channels are unmarked with the ROI bit as the cursor is moved with <→> or <←> into the channel. Moving the marker with the mouse does not alter the ROI in this mode. This function is duplicated by **<Alt + U>** and by **<F2>** (which toggles between **Off**, **Mark**, and **UnMark**).

4.5.4. Mark Peak

This function marks an ROI in the spectrum, at the marker position, in one of two ways.

- If the spectrum is calibrated, the region is centered on the marker with a width of three times the calibrated FWHM. There does not need to be a peak at the marker position.

- If the spectrum is not calibrated, the region is centered on the peak located within two channels of the marker and as wide as the peak. If the peak search fails, or if the peak is not well-formed, no ROI is marked. There is no limit on the size of a peak or ROI; therefore, in some uncalibrated spectra, large ROIs might be marked.

ROIs can also be marked this way with the **ROI Ins** button on the Status Sidebar, the **Mark ROI** button on the Toolbar, **Keypad<Ins>**, and **<Insert>**. See also **Mark ROI** on the right-mouse-button menu, Section 4.8.8.

4.5.5. Clear

This clears the ROI bits of all ROI channels contiguous to the channel containing the marker. This is duplicated by the **ROI Del** button on the Status Sidebar, **Keypad<Del>**, the **<Delete>** key, and the **Clear ROI** Toolbar button. See also **Clear ROI** on the right-mouse-button menu, Section 4.8.9.

4.5.6. Clear All

This resets all the ROI bits in the displayed spectrum (i.e., removes all ROI markings from the spectrum). However, it does not affect the ROI status of **Mark**/**Unmark**/**Off**.

4.5.7. Save File...

This allows you to save to disk a table of the channel numbers, for the current spectrum, that have the ROI set. The contents of the spectrum are not changed.

Selecting **Save File...** opens a standard file-open dialog (Fig. 92). Enter the **File name**. The `.ROI` file extension is recommended, and is used by default. An invalid or null filename will abort the **Save** operation.

If the file already exists, the system will display a warning message asking if you want to overwrite the data in the existing file or cancel the save. Click on **OK** to overwrite the file.

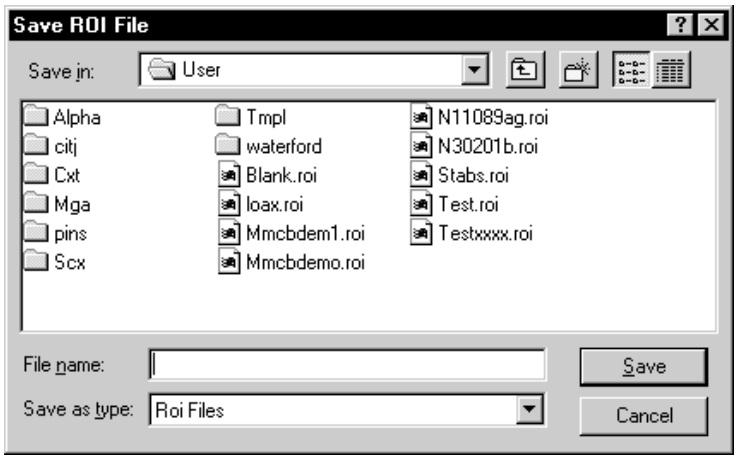


Fig. 92. Save ROI File Dialog.

4.5.8. Recall File...

Recall File... sets the ROIs in the buffer or active Detector to the table in the disk file created by **ROI/Save File...** (Section 4.5.7), or from the table stored in an `.SPC` file. This command opens the dialog shown in Fig. 93, prompting you to select a filename. When a file is selected, the ROIs in the buffer or active Detector are set to conform to the table in the file. The previous ROIs are cleared. The data contents of the buffer or Detector are not altered by this operation, only the ROI bits in the buffer or Detector.

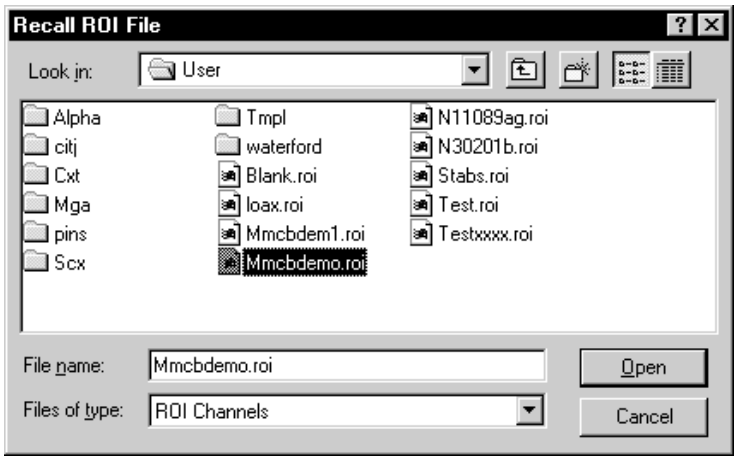


Fig. 93. ROI File Recall Dialog.

In `.ROI` and spectrum files, the ROIs are saved by channel number. Therefore, if the spectrum peaks have shifted in position, the ROIs in the file will not correspond exactly to the spectrum data.

4.6. Display

Two of the most important functions of MAESTRO are to display the spectrum data and to provide an easy and straight-forward way to manipulate the data. This is accomplished using the **Display** menu functions, shown in Fig. 94, and their associated accelerators. The **Display** functions are available in both the Detector and buffer modes.

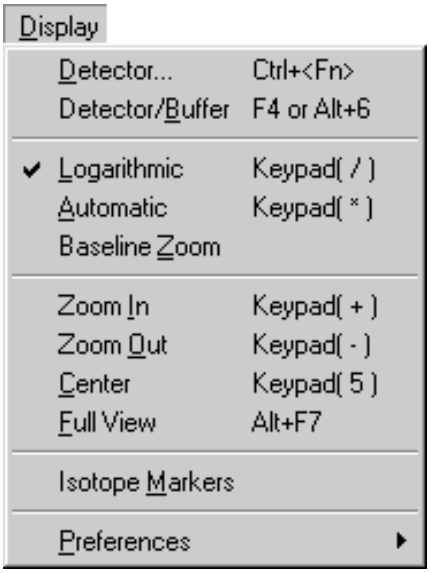


Fig. 94. Display Menu.

4.6.1. Detector...

Selecting this function opens the **Pick Detector** list shown in Fig. 95. Click on a Detector on this list to display its memory in the Full and Expanded Spectrum Views. The **Pick Detector** list shows the available Detectors, listed by Detector number, and a brief description.

This is duplicated by the Detector droplist on the Toolbar (see page 19). In addition, the first 12 Detectors on the list can be selected by pressing **<Ctrl + F1>** for the first Detector in the pick list, **<Ctrl + F2>** for the second Detector, and so on, through **<Ctrl + F12>** (see Section 5.4.8).

The current pick list is selected from the Master Detector List using **Services**/**Edit Detector List...**, as discussed in Section 4.4.5.

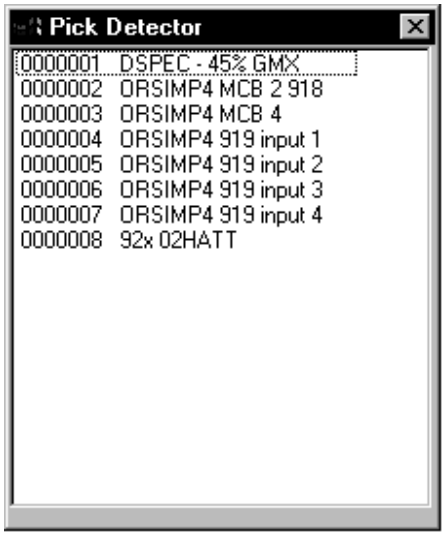


Fig. 95. Detector Selection List.

4.6.2. Detector/Buffer

This command switches the active window spectrum and Status Sidebar displays between the last active Detector and the last active buffer. The Full and Expanded Spectrum Views display the data in histogram form. This function is duplicated by the accelerators **<F4>** and **<Alt + 6>**. You can also use the Toolbar's Detector droplist.

4.6.3. Logarithmic

Logarithmic toggles the vertical scale of the Spectrum display between the logarithmic and linear modes. This function is duplicated by **Keypad</>** and the **Log/Linear Display** button on the Toolbar.

4.6.4. Automatic

Automatic switches the Expanded Spectrum View to a linear scale that is automatically adjusted until the largest peak shown is at its maximum height without overflowing the display. It also toggles the vertical scale of the spectrum display between the automatic and manual modes. If the logarithmic scale was enabled, the display is switched to linear. This function is duplicated by **Keypad<*>** and the **Vertical Auto Scale** Toolbar button.

4.6.5. Baseline Zoom

When you select **Baseline Zoom**, the baseline of the spectrum displayed in the expanded view is always zero counts. In this mode, a checkmark is displayed beside the item name on the menu. When Baseline Zoom is off (no checkmark beside the item name), the baseline can be offset to a higher value. This is useful to show small peaks on a high background. When the baseline is offset, the box in the Full Spectrum View is raised above the baseline to show the offset. This is duplicated on the toolbar and right-mouse-button menu.

4.6.6. Zoom In

Fig. 96. Vertical and Horizontal Full-Scale Setting on the Toolbar.

Zoom In adjusts the horizontal and vertical scales in the Expanded Spectrum View to view a smaller portion of the spectrum. The vertical scale is divided by two and the horizontal scale is reduced by about 6% of the full horizontal scale. The current horizontal and vertical full-scale values are shown on the Toolbar (see Fig. 96). This command is duplicated by **Keypad<+>**, the Toolbar's **Zoom In** button, and **Zoom In** on the right-mouse-button menu.

4.6.7. Zoom Out

Zoom Out adjusts the horizontal and vertical scales in the Expanded Spectrum View to view a larger portion of the spectrum. The vertical scale is doubled and the horizontal scale is increased by about 6% of the full horizontal scale. This command is duplicated by **Keypad<–>**, the Toolbar's **Zoom Out** button, and **Zoom Out** on the right-mouse-button menu.

4.6.8. Center

This function forces the marker to the center of the screen by shifting the spectrum without moving the marker from its current channel. This function is only required when moving the marker with the mouse; the keyboard functions for moving the marker automatically shift the spectrum to center the marker when the marker travels past the end of the current expanded display. **Center** is duplicated by **Keypad<5>** and the **Center** button on the Toolbar.

4.6.9. Full View

This function sets the Expanded Spectrum View to the maximum number of channels in the spectrum (the ADC conversion gain).

4.6.10. Isotope Markers

The isotope markers are used to locate other gamma rays of the same nuclide (from the library) when any one of the gamma rays from that nuclide is selected. In this way, you can easily see if the selected nuclide is present by comparing the spectrum peaks with the displayed markers. The marker is a solid color rectangle placed at the energy of the gamma ray, with the nuclide name shown above the top of the rectangle (Fig. 97). The markers are shown in both the full view and the expanded view (Fig. 98). The base of the rectangle is positioned at the level of the background for the peak.

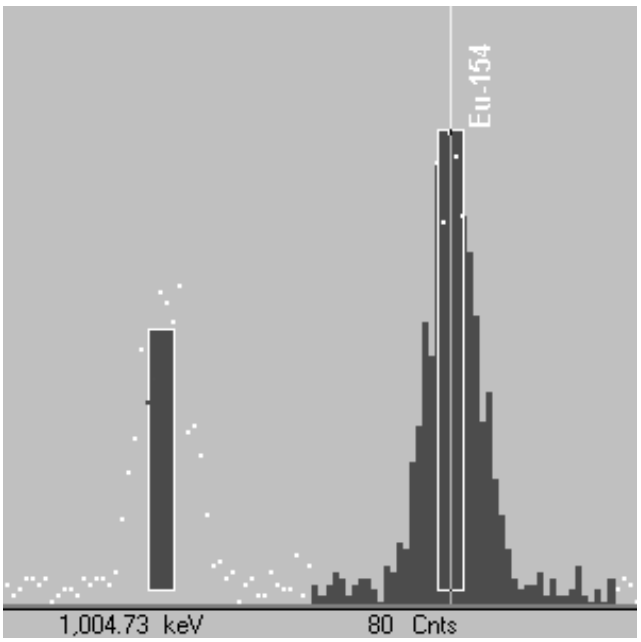


Fig. 97. Isotope Markers.

The amplitude of the marker for the selected peak is normally proportional to the peak area. However, the amplitude can be changed by placing the mouse in the rectangle, where it will become a double-sided arrow. While the double arrow is displayed, press and hold the left mouse button and move the pointer higher or lower on the y-axis to make the rectangle larger or smaller. The amplitude of the marker for the other peaks is proportional to the amplitude of the first peak and the branching ratio. As the amplitude of the peak is changed with the mouse, all the other rectangles will change proportionally.

The markers are shown in one of two colors. If the peak area, calculated in the same manner as for **Peak Info**, is positive (indicating the peak was found), then the rectangle is one color (normally green). If the peak area is negative or zero (indicating the peak was not found), then the rectangle is another color (normally blue).

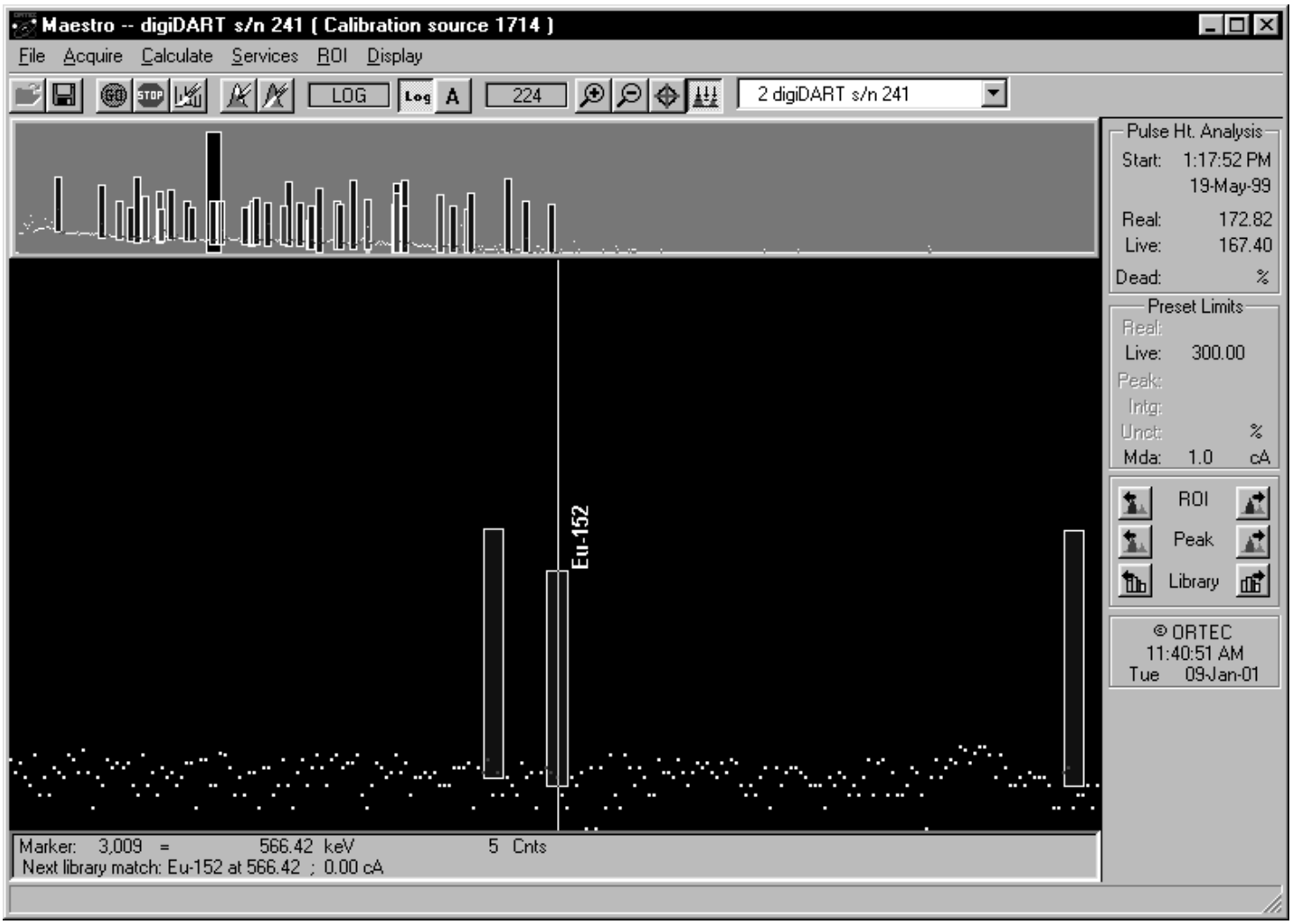


Fig. 98. Isotope Markers, Expanded View.

4.6.11. Preferences...

This displays the options available for selecting the screen colors and spectrum display options. The submenu is shown in Fig. 99.

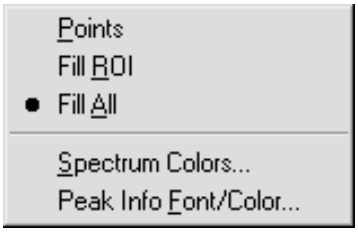


Fig. 99. Display Preferences Submenu.

4.6.11.1. Points/Fill ROI/Fill All

Use these functions to select the histogram display mode for both spectrum windows.

In **Points** mode, the data are displayed as points or pixels on the screen, in the colors chosen for **Foreground** and **ROI** under **Display**/**Preferences**/**Spectrum Colors...** (see Section 4.6.11.2).

In **Fill ROI** mode, the unmarked regions of the spectrum are displayed as points, while the ROIs are filled from the baseline to the data point with the **ROI** spectrum color.

In **Fill All** mode, all the data points are filled from the baseline to the data point with the **Foreground** and **ROI** spectrum colors.

Figure 100 shows a comparison of the three display modes. Note that the point/pixel size in the **Point**- and **Fill ROI**-mode illustrations has been exaggerated to make them easier to see.

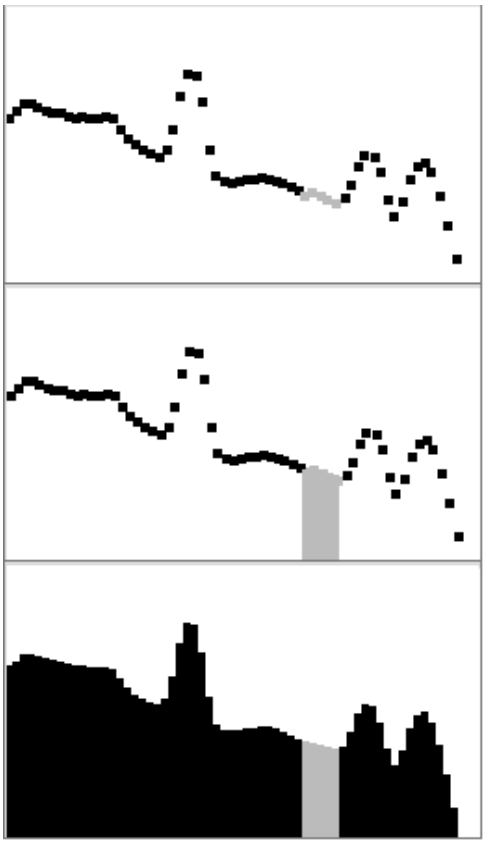


Fig. 100. Comparison of the Points, Fill ROI, and Fill All Display Modes.

4.6.11.2. Spectrum Colors...

Use this dialog (see Fig. 101) to select colors for various features in the two spectrum windows. Each scroll bar controls the color of a different feature. The vertical colored stripes behind the scroll bars show the available colors.

The **Background** scroll bar controls the background color of the spectrum window, **Foreground** determines the color of the spectrum points or fill, **ROI** governs the color of the ROI points or fill. The points/fill of a compared spectrum (**File**/**Compare...**) use the **Compare** color, unless they overlap with the original spectrum, in which case the **Composite** color is used.

To change a color, click and hold the left mouse button on the scroll bar button and drag it slowly across the different colors. When the desired color is displayed in the box beside the **OK** button, release the mouse button. The spectrum window will immediately change color.

To cancel a color change, return the slider button to its starting color, or close the **Spectrum Colors...** palette by clicking on **Cancel** or pressing **<Esc>**.

To reset the color values to the original MAESTRO colors, click on **Defaults**.

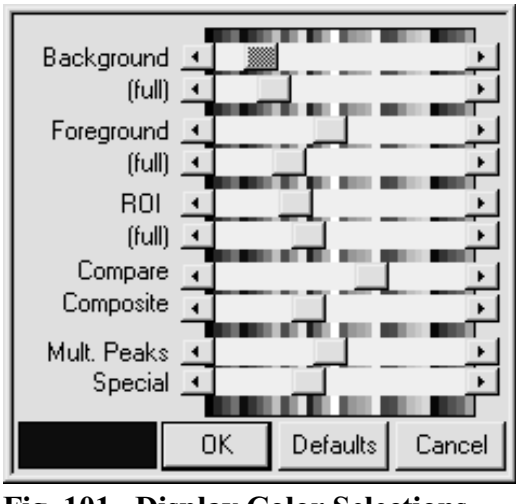


Fig. 101. Display Color Selections.

To accept the color changes, click on **OK**. These color changes will be recalled the next time MAESTRO is started.

NOTE The **Spectrum Colors...** affect only the spectrum windows. The colors of the remaining features on the screen must be changed using the Windows Control Panel (which will also, of course, affect the appearance of all other Windows applications on this PC).

4.6.11.3. Peak Info Font/Color

This function opens the **Font** dialog (see Fig. 102). It allows you to select the font type, size, and color used to display **Peak Info** data in the text box in the spectrum windows (see Section 4.3.4, Fig. 75).

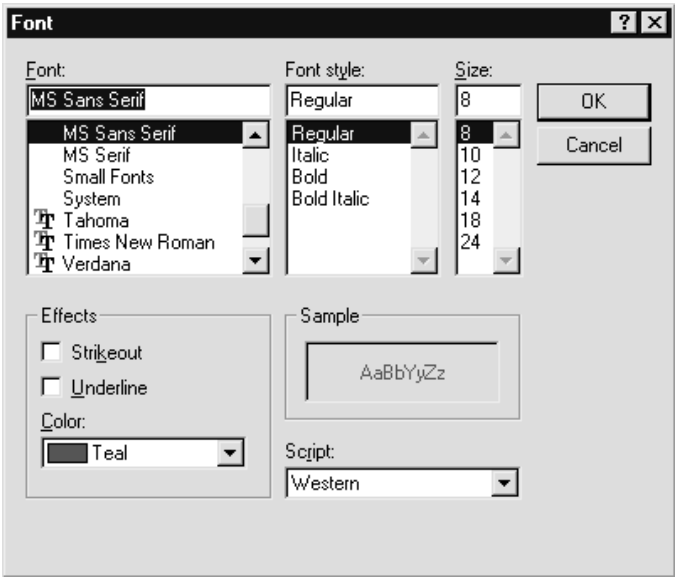


Fig. 102. Peak Info Font Selection.

4.7. Window

This menu contains standard Windows commands for controlling the display of the spectrum windows (Fig. 103). In addition to the spectrum window display mode (**Cascade**, **Tile Horizontal**, **Tile Vertical**, etc.), the list of open buffer and Detector windows is shown. The currently active spectrum is checkmarked.

MAESTRO now has a **Multiple Windows** command that lets you choose between the newer multiple-detector-window mode and the original single-detector-window mode.

In single-window mode (no checkmark beside **Multiple Windows**), to make another window the active window, click on its entry in the list. This is especially useful if one window has been enlarged and has obscured other windows.

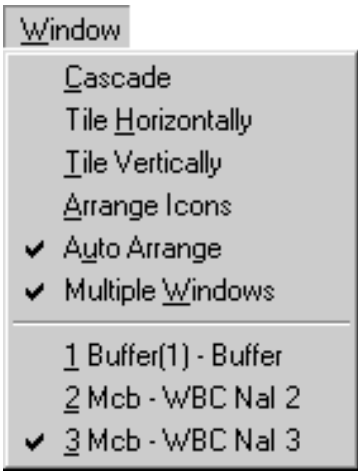


Fig. 103. Window Menu.

4.8. Right-Mouse-Button Menu

Figure 104 shows the right-mouse-button menu. To open it, position the mouse pointer anywhere in the desired spectrum window, and click the right mouse button, then use the left mouse button to select from its list of commands.

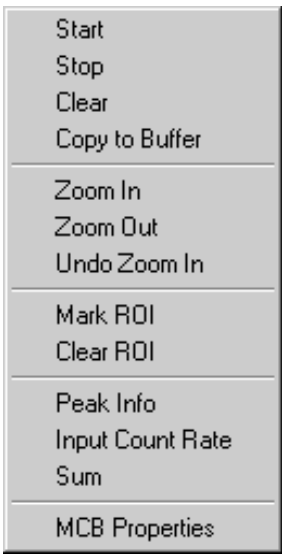


Fig. 104. Right-Mouse-Button Menu for Spectra.

4.8.1. Start

This initiates data collection in the selected Detector. Any warnings arising from problems detected at the hardware level will appear in a message box or on the Supplemental Information Line at the bottom of the display. The Detector can also be started with the **<Alt + 1>** accelerator, the **Start Acquisition** button on the Toolbar, or the **Start** command on the right-mouse-button menu. If the Detector is already started or if a buffer window is active, this entry is grayed.

4.8.2. Stop

The **Stop** command is available only in Detector windows, and terminates data collection in the active Detector. If the Detector is not active, the entry is grayed. The Detector can also be stopped with the accelerator **<Alt+ 2>,** the **Stop Acquisition** button on the Toolbar, and the **Stop** command on the right-mouse-button menu.

4.8.3. Clear

Clear erases the spectral data and descriptors (e.g., real time, live time, start time) in the active Detector or buffer window. The presets are not altered. (This function might not operate on some types of Detectors when they are collecting data.) The data can also be cleared with **<Alt+ 3>**, the **Clear Spectrum** button on the Toolbar, or the **Clear** command on the right-mouse-button menu.

4.8.4. Copy to Buffer

The **Copy to Buffer** function transfers the data and descriptors (e.g., live time, real time), from the active Detector window to a new buffer window. This function can also be performed with **<Alt + 5>**, the **Copy Spectrum to Buffer** Toolbar button, or the **Copy to Buffer** command on the right-mouse-button menu.

4.8.5. Zoom In

Zoom In adjusts the horizontal and vertical scales in the Expanded Spectrum View to view a smaller portion of the spectrum. If the rubber rectangle is not being used, the vertical scale is

divided by two and the horizontal scale is reduced by about 6% of the full horizontal scale. If the rubber rectangle is being used, the display shows only the contents of the rectangle. The current horizontal and vertical full-scale values are shown on the Toolbar.

This command (not using the rubber rectangle) is duplicated by **Keypad<+>**, the Toolbar's **Zoom In** button, and **Zoom In** on the **Display** menu.

4.8.6. Zoom Out

Zoom Out adjusts the horizontal and vertical scales in the Expanded Spectrum View to view a larger portion of the spectrum. The vertical scale is doubled and the horizontal scale is increased by about 6% of the full horizontal scale.

This command is duplicated by **Keypad<–>**, the Toolbar's **Zoom Out** button, and **Zoom Out** on the **Display** menu.

4.8.7. Undo Zoom In

This will undo or reverse the last **Zoom In** operation done with the rubber rectangle. It restores the display to the horizontal and vertical expansion before the **Zoom In**. It is not the same as **Zoom Out**.

4.8.8. Mark ROI

This function marks an ROI in the spectrum for the total width of the rubber rectangle. All channels are marked. See also Sections 3.5.3 and 4.5.4.

4.8.9. Clear ROI

This clears the ROI bits of all channels in the rubber rectangle or all ROI channels contiguous to the channel containing the marker. See also Section 4.5.5.

4.8.10. Peak Info

If the marker is in an ROI, this displays one of the following:

- If the spectrum is not calibrated, the channel centroid, FWHM, and FW(1/x)M, in channels, are displayed.

- If calibrated, the channel centroid, FWHM, and FW(1/x)M, in channels and energy, the gross and net area, and the library "best match" are displayed.

The x-factor is determined in **Calculate/Settings...**. The peak information is displayed in a pop-up box at the top of the peak (Fig. 75). This is duplicated by double-clicking the mouse in the ROI or with **Calculate/Peak Info**. To close the box, left-click on it or press **<Esc>**.

If the Detector is acquiring data, the values displayed are continuously updated with new values based on the new data.

See Section 4.3.4 for peak calculation details.

4.8.11. Input Count Rate

This enables the display (upper left corner of spectrum) of the input count rate meter for those MCBs that have one (for instance, the DSPEC Pro and digiDART). The input count rate is the total count rate into the input and is higher than the total number of counts in the spectrum divided by the real time. It is the count rate used in the dead-time calculation.

4.8.12. Sum

The **Sum** function performs its calculation in one of two ways, depending on the position of the marker:

- If the marker is not in an ROI, the sum of the data channels of the Detector is shown on the display. The complete channel width (e.g., 1 to 16384) is summed.

- If the marker is in an ROI, the sum of the data channels in the ROI is shown on the display. This is the same as the gross counts in the **Peak Info** display, but can be used on wider ROIs.

4.8.13. MCB Properties

This displays the MCB Properties as described in Section 4.2.7 for the selected Detector.

5. KEYBOARD COMMANDS

This chapter describes the MAESTRO keyboard commands. The keys described in this section are grouped primarily according to location on the keyboard and secondarily by related function.

5.1. Introduction

Table 3 provides a quick reference to all of the MAESTRO keyboard and keypad functions. These accelerators are also illustrated in Fig. 105, and discussed in more detail in the remainder of the chapter.

The accelerators are available only in the MAESTRO window. The Title Bar must be highlighted with the active title bar color (as set up in Windows Control Panel). In addition, the active cursor — or input *focus* — must be in the spectrum window. Similar to other Windows applications, the input focus can be switched between MAESTRO and other applications by clicking on the Windows Taskbar, pressing **<Alt + Tab>**, or, if the inactive window is visible, pointing with the mouse at some spot in the inactive window and clicking.

The multi-key functions, such as **<Alt + 1>** or **<Shift + →>**, are executed by holding down the first key (e.g., **<Alt>**, **<Shift>**, or **<Ctrl>**) while pressing the key that follows the "+" sign in the brackets, then releasing both keys simultaneously. Functions that use the keypad keys begin with the word **Keypad**, e.g., **Keypad<5>**.

As usual for any Windows application, the menus are accessed by clicking on them with the mouse, or by using the **Alt** key plus the key that matches the underlined letter in the menu item name. For example, the multi-key combination to activate the **File** menu is **<Alt + F>**.

Note that the MAESTRO accelerator keys do not interfere with Windows menu operations or task switching. For example, when a menu is active (i.e., pulled down), the <←>/<→> and <↑>/<↓> keys revert to their normal Windows functions of moving across the menu bar and scrolling up/down within a menu, respectively. As soon as the menu is closed, they behave as MAESTRO accelerators again.

5.2. Marker and Display Function Keys

5.2.1. Next Channel <→>/<←>

The right and left arrow keys move the marker by one displayed pixel in the corresponding direction. This might represent a jump of more than one spectral data memory channel, especially if the horizontal scale in channels is larger than the width in pixels of the window (see the discussion in Section 3.3).

Table 3. Quick Reference to MAESTRO Keyboard Commands.

Key	Function
<↓> or <F5>	Change vertical scale so spectrum peaks are smaller.
<↑> or <F6>	Change vertical scale so spectrum peaks are larger.
<→>	Move marker to higher channel.
<←>	Move marker to lower channel.
<–> or <F7>	Narrow the horizontal scale.
<+> or <F8>	Widen the horizontal scale.
<Ctrl + →>	Jump to next higher peak.
<Ctrl + ←>	Jump to next lower peak.
<Shift + →>	Jump to next higher ROI.
<Shift + ←>	Jump to next lower ROI.
<Alt + →>	Jump to next library entry.
<Alt + ←>	Jump to previous library entry.
<PageUp>	Jump to higher channel number in 1/16th-screen-width increments.
<PageDown>	Jump to lower channel number in 1/16th-screen-width increments.
<Home>	Jump to first channel of the full spectrum.
<End>	Jump to last channel of the full spectrum.
<Ctrl + Fi>	Select Detector i (i = 1 to 12, in pick list order).
<F2>	Switch ROI bit control from OFF to SET to CLEAR.
<F3>	In MCBs that support ZDT mode, switch between the two spectra stored in ZDT mode.
<Shift + F3>	In MCBs that support ZDT mode, switch the disk spectrum to compare normal to disk ZDT spectrum or ZDT spectrum to disk normal spectrum.
<F4> or <Alt + 6>	Switch between displaying selected Detector and buffer.
<F5> or <↓>	Change vertical scale so that spectrum peaks are smaller.
<F6> or <↑>	Change vertical scale so that spectrum peaks are larger.
<F7> or <–>	Narrow the horizontal scale.
<F8> or <+>	Widen the horizontal scale.
<Alt + F7>	Sets the Expanded Spectrum View to the full spectrum.
Keypad<–>	Zoom out.
Keypad<+>	Zoom in.
Keypad<5>	Center expanded display on cursor.
Keypad</>	Switch to logarithmic vertical scale.
Keypad<*>	Switch to auto vertical scale.
Insert<Ins>	Mark the peak region around the cursor as an ROI.
Delete<Del>	Clear the ROI.
<Shift + ↑>	Shift the compare spectrum upwards.
<Shift + ↓>	Shift the compare spectrum downwards.
<Alt + 1>	Start acquisition in selected Detector.
<Alt + 2>	Stop acquisition in selected Detector.
<Alt + 3>	Clear data in selected Detector.
<Alt + 5>	Copy data in the selected Detector to the buffer.
<Alt + 6> or <F4>	Switch between displaying selected Detector and buffer.
<Alt + –>	Decrease amplifier fine gain by smallest increment (where supported).
<Shift + Alt + –>	Decrease amplifier fine gain by several increments.
<Alt + +>	Increase amplifier fine gain by smallest increment.
<Shift + Alt + +>	Increase amplifier fine gain by several increments.
<PrintScreen>	Capture screen to Windows Clipboard.

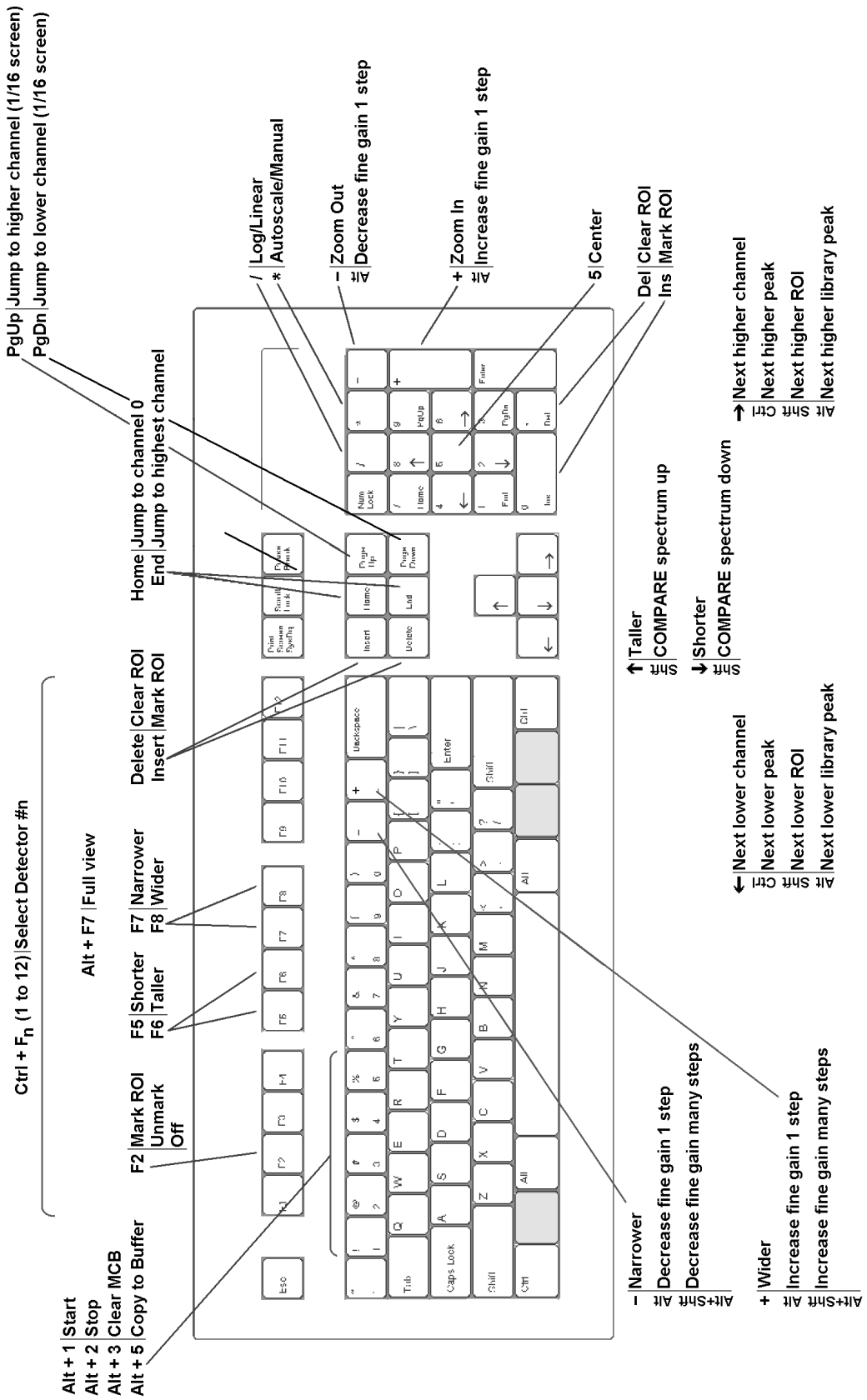

PgUp Jump to higher channel (1/16 screen)
PgDn Jump to lower channel (1/16 screen)
Ctrl + Fn (1 to 12) Select Detector #n
Alt + F7 Full view
Alt + 1 Start
Alt + 2 Stop
Alt + 3 Clear MCB
Alt + 5 Copy to Buffer
F2 Mark ROI
Unmark
Off
F5 Shorter
F6 Taller
F7 Narrower
F8 Wider
Delete Clear ROI
Insert Mark ROI
Home Jump to channel 0
End Jump to highest channel
/ Log/Linear
* Autoscale/Manual
– Zoom Out
Alt Decrease fine gain 1 step
+ Zoom In
Alt Increase fine gain 1 step
5 Center
Del Clear ROI
Ins Mark ROI
↑ Taller
Shift COMPARE spectrum up
↓ Shorter
Shift COMPARE spectrum down
– Narrower
Alt Decrease fine gain 1 step
Alt+Shft Decrease fine gain many steps
+ Wider
Alt Increase fine gain 1 step
Alt+Shft Increase fine gain many steps
← Next lower channel
Ctrl Next lower peak
Alt Shft Ctrl Next lower ROI
Alt Shft Next lower library peak
→ Next higher channel
Ctrl Next higher peak
Alt Shft Ctrl Next higher ROI
Alt Shft Next higher library peak

Fig. 105. MAESTRO Keyboard and Keypad Accelerators.

If the horizontal scale is expanded, when the marker reaches the edge of the spectrum window, the next key press past the edge shifts the window to the next block of channels in that direction such that the marker is now in the center of the display.

When the ROI mode is set to **Mark**, the <→>/<←> keys cause the channels to be marked as the marker moves. Similarly, they clear the ROI bits while the ROI mode is **UnMark** (see Section 4.5).

5.2.2. Next ROI <Shift + →>/<Shift + ←>

The <**Shift** + →> or <**Shift** + ←> move the marker to the beginning of the next higher channel ROI, or the end of the preceding ROI, respectively, of the displayed spectrum. These functions are duplicated by the **ROI** indexing buttons on the Status Sidebar.

5.2.3. Next Peak <Ctrl + →>/<Ctrl + ←>

The <**Ctrl**+ →> and <**Ctrl**+ ←> keys perform a peak search on the spectrum in the higher or lower channel direction, respectively, and move the marker to the first peak found. If no peak is found, the program displays the "**No More Peaks**" message and the marker does not move. If the spectrum is energy-calibrated and the library loaded, the system displays the best match from the library within two FWHMs of the peak centroid. If there is no match within this range, the "**No Close Library Match**" message is displayed. These functions are duplicated by the **Peak** indexing buttons on the Status Sidebar.

5.2.4. Next Library Entry <Alt + →>/<Alt + ←>

These keys move forward or backward through the nuclide library to the next closest library entry. Each button press advances to the next library entry and moves the marker to the corresponding energy. Also, instead of indexing from a previously identified peak, the marker can be positioned anywhere in the spectrum and these keys used to locate the entries closest in energy to that point. If a warning beep sounds, it means that all library entries have been exhausted in that direction, or that the spectrum is not properly calibrated for reaching the energy with the marker. In any case, if an appropriate peak is available at the location of the marker, data on the peak activity are displayed on the Marker Information Line. These functions are duplicated by the **Library** indexing buttons on the Status Sidebar.

5.2.5. First/Last Channel <Home>/<End>

These keys move the marker to the first or last channel of the spectrum.

5.2.6. Jump (Sixteenth Screen Width) <PageDown>/<PageUp>

<PageDown> and **<PageUp>** jump the marker position to the left (to lower channel numbers) or right (to higher channel numbers), respectively, 1/16 of the window width, regardless of the horizontal scale. The status of the ROI bit is not altered when the marker is moved with these keys, that is, the **Mark/UnMark/Off** state is ignored. The marker channel contents and Marker Information Line are continuously updated as the marker jumps, so when the jump is complete, the marker information is up-to-date for the current channel.

5.2.7. Insert ROI <Insert> or Keypad<Ins>

These keys mark an ROI in the spectrum, at the marker position, in one of two ways:

1. If the spectrum is calibrated, the region is centered on the marker with a width of three times the calibrated FWHM. There does not need to be a peak at the marker position.

2. If the spectrum is not calibrated, the region is centered on the peak, if any, located within two channels of the marker and is as wide as the peak. If the peak search fails, or if the peak is not well-formed, no ROI is marked. There is no limit on the size of a peak or ROI; therefore, in some uncalibrated spectra, large ROIs could be marked.

These accelerators duplicate the function of the **Mark ROI** Toolbar button and the **ROI/Mark Peak** menu selection (see Section 4.5).

NOTE **<Insert>** and **Keypad<Ins>** work conveniently in combination with **<Ctrl** + ←> and **<Ctrl** + →> to rapidly set peak ROIs.

5.2.8. Clear ROI <Delete> or Keypad<Del>

<Delete> and **Keypad<Del>** clear the ROI bits of all ROI channels contiguous to the channel containing the marker. These accelerators duplicate the function of the **Clear ROI** button on the Toolbar and the **ROI/Clear** menu selection (see Section 4.5).

5.2.9. Taller/Shorter <↑>/<↓>

The <↑> and <↓> keys decrease or increase the vertical full scale of the displayed spectrum so the peaks appear taller or shorter, respectively. The minimum is 16 counts-full-scale; the maximum is 1024 million counts. Each successive key press doubles or halves the full scale until the maximum or minimum is reached. Whenever the maximum full-scale value is reached, the next <↑> key press switches to logarithmic scale. If the display is already in logarithmic scale, the display switches to linear scale. In either case, the vertical full-scale value is always shown on the Toolbar.

Note that if the number of counts exceeds the full-scale value, the data points will be displayed at the full-scale value.

These keys duplicate the function of the **<F6>**/**<F5>** keys.

5.2.10. Compare Vertical Separation <Shift+↑>/<Shift+↓>

In Compare mode, the **<Shift** + ↑> or **<Shift** + ↓> keys decrease or increase the vertical separation between the two spectra. Each successive key press will increase or decrease the separation by moving the spectrum read from disk. The spectrum from disk can be moved below the first spectrum if it has fewer counts.

5.2.11. Zoom In/Zoom Out Keypad<+>/<–>

Keypad<+> increases the scale of both axes in the Expanded Spectrum View so the peaks appear larger, while **Keypad**<–> does the opposite, making the peaks look smaller. The scale value for both axes is always shown on the Toolbar.

These functions are duplicated by the **Zoom In**/**Zoom Out** buttons on the Toolbar and **Zoom In** and **Zoom Out** under the **Display** menu. See Section 3.3 for a more detailed discussion.

5.2.12. Fine Gain <Alt + +>/<Alt + –>

These accelerators step the internal amplifier up or down by one increment of fine gain on the selected Detector, if it has a software-controlled amplifier. The new fine gain setting is shown on the Supplemental Information Line at the bottom of the screen. If the gain stabilizer is active, the display of the histogram data might not change.

The fine gain can also be set with **Acquire/Adjust Controls...** (Section 3.2.3), **<Shift** + **Alt** + +>/ **<Shift** + **Alt** + –> on the keyboard, and **Keypad**<**Alt** + +>/ <**Alt** + –>.

5.2.13. Fine Gain (Large Move) <Shift + Alt + +>/<Shift + Alt + –>

<Shift+Alt+ +> and **<Shift+Alt+** –> step the internal amplifier of the selected Detector (if it has a software-controlled amplifier) up or down by a large increment of fine gain. If the gain stabilizer is active, the display of the histogram data might not change.

The fine gain can also be set using **Acquire/Adjust Controls...** (Section 3.2.3), **<Alt+** +>/ **<Alt+** –> on the keyboard, and **Keypad**<**Alt** + +>/ <**Alt** + –>.

5.2.14. Screen Capture <PrintScreen>

The **<PrintScreen>** key captures the entire monitor display to the Windows Clipboard, where it is available for use in other applications such as word processors, Windows Paint. Some older keyboards require **<Alt + PrintScreen>** or **<Shift + PrintScreen>**.

A typical usage would be to set up the display as desired for the snapshot (you might wish to use **Display**/**Preferences**/**Spectrum Colors...** to select black or white for all areas rather than colors, since they produce clearer printouts), then press **<PrintScreen>**. Start the desired graphics or word processing application. Copy the image from the Clipboard with **<Ctrl + V>** or **Edit**/**Paste** (refer to the documentation for the graphics or word processing program). See the Inbit™ FullShot™ manual for other screen-capture and screen-printing methods.

5.3. Keyboard Number Combinations

NOTE Only the key*board* numbers will function in the following combinations. The key*pad* number keys will *not* perform these functions.

5.3.1. Start <Alt + 1>

<Alt + 1> starts the acquisition in the selected Detector. Any presets desired must be entered before starting acquisition. This accelerator duplicates the **Start** Toolbar button, the **Start** command on the right-mouse-button menu, and **Acquire**/Start.

.

5.3.2. Stop <Alt + 2>

<Alt + 2> stops acquisition in the selected Detector. This duplicates the **Stop** Toolbar button, the **Stop** command on the right-mouse-button menu, and **Acquire**/**Stop**.

5.3.3. Clear <Alt + 3>

<Alt + 3> clears the displayed Detector's histogram data and its descriptors (e.g., real time, live time). This accelerator duplicates the **Clear Spectrum** Toolbar button, the **Clear** command on the right-mouse-button menu, and **Acquire**/**Clear**.

5.3.4. Copy to Buffer <Alt + 5>

<Alt + 5> copies the histogram data from the selected Detector to the buffer, along with its descriptors (e.g., live time, real time), and displays the spectrum in a new window. This duplicates the **Copy to Buffer** Toolbar button, the **Copy to Buffer** command on the right-mouse-button menu, and **Acquire**/**Copy to Buffer**.

5.3.5. Detector/Buffer <Alt + 6>

<Alt + 6> switches the display between the histogram of the spectrum in the selected Detector and the spectrum in the buffer. The buffer will have the memory size of the spectrum that was last transferred from Detector or disk file. The Detector list on the right side of the Toolbar indicates whether the buffer or a particular Detector is currently displayed, and the Status Sidebar shows the presets for the displayed data. This duplicates **<F4>** and **Display**/**Detector**/**Buffer**.

5.3.6. Narrower/Wider <+>/<–>

The <+> key increases the horizontal scale of the Expanded Spectrum View so the peaks appear wider, while the <–> key decreases the horizontal scale, making the peaks look narrower. The horizontal and vertical scale values are displayed on the Toolbar. These functions are duplicated by **<F7>**/**<F8>**.

5.4. Function Keys

5.4.1. ROI <F2>

The **<F2>** key switches the ROI marker status among the **Mark**, **UnMark**, and **Off** conditions, so you can use the marker to set or clear the ROI bits for particular channels or groups of channels, or return the marker to normal usage. The current ROI marking status (**Marking**, **Unmarking**) is shown in at the extreme right of the Menu Bar (**Off** mode is shown as blank). ROI bits are changed by using the keyboard to move the marker to a channel, as follows:

- **Mark** The channel is marked (set) as an ROI with the marker.
- **UnMark** The channel is removed from the ROI (reset) with the marker.
- **Off** The ROI status is unchanged with the marker.

5.4.2. ZDT/Normal <F3>

For the DSPEC Plus in ZDT mode, the **<F3>** key switches between the normal (LTC) or uncertainty (ERR) spectrum and the ZDT corrected spectrum. It duplicates the **Acquire**/**ZDT Display Select** command.

5.4.3. ZDT Compare <Shift+F3>

For the DSPEC Plus in Compare mode, this accelerator switches the compare spectrum between the ZDT spectrum and its accompanying LTC or ERR spectrum. Used in combination with **<F3>** or **Acquire**/**ZDT Display Select**, it allows you to display the normal-to-ZDT, uncertainty-to-ZDT, ZDT-to-normal, or ZDT-to-uncertainty comparisons.

5.4.4. Detector/Buffer <F4>

The **<F4>** key switches between the display of the data in the Detector and the data in the buffer. It duplicates the function of **<Alt + 6>** and **Display/Detector/Buffer**; see Section 5.3.5.

5.4.5. Taller/Shorter <F5>/<F6>

These keys decrease or increase the vertical full scale of the displayed spectrum so the peaks appear taller or shorter, respectively. They duplicate the function of the <↑> and <↓> keys. The vertical scale value is always shown on the Toolbar.

5.4.6. Narrower/Wider <F7>/<F8>

These keys increase or decrease the horizontal scale of the data display so the peaks appear narrower or wider, respectively. They duplicate the function of <–> and <+> keys. The horizontal scale value is always shown on the Toolbar.

5.4.7. Full View <Alt + F7>

Full View adjusts the horizontal and vertical scaling to display the entire spectrum in the Expanded Spectrum View. This duplicates **Display/Full View**; see Section 4.6.9.

5.4.8. Select Detector <Ctrl + F1> through <Ctrl + F12>

These keys open a new window and display the spectrum for the specified Detector **n** (where **n** = 1 to 12, corresponding to **<Ctrl+ Fn>**, in the order that the Detectors are defined in the Detector pick list; see Section 4.6.1). The selected Detector name (or the buffer) is shown on the Toolbar.

These keys duplicate the function of the Detector pick list on the Toolbar, and the **Detector...** dialog under the **Display** menu. However, you should be aware of which Detector numbers are available when using the function keys. An error message box will appear if the selected Detector is invalid. In systems with more than 12 Detectors, use **Display/Detector...** or the Detector droplist on the Toolbar.

5.5. Keypad Keys

5.5.1. Log/Linear Keypad</>

Keypad</> toggles the active spectrum window between logarithmic and linear vertical display. This is duplicated by the **Log** Toolbar button. The vertical scale can be controlled with the **Zoom In/Zoom Out** Toolbar buttons, **Keypad<+>/<–>**, the <↑> and <↓> keys, and **<F7/F8>**.

5.5.2. Auto/Manual Keypad<*>

Keypad<*> switches the spectrum window between automatic and manual vertical full scale (see the discussion in Section 4.6.4). This is duplicated by the **Vertical Auto Scale** button on the Toolbar.

5.5.3. Center Keypad<5>

Keypad<5> forces the marker to the center of the screen by shifting the spectrum without moving the marker from its current channel. This is duplicated by the **Center** button on the Toolbar. For more information, see Section 4.6.8.

5.5.4. Zoom In/Zoom Out Keypad<+>/<–>

Keypad<+> increases the scale of both axes in the Expanded Spectrum View so the peaks appear larger, while **Keypad<–>** does the opposite, making the peaks look smaller. The scale

value for both axes is always shown on the Toolbar. These functions are duplicated by the **Zoom In/Zoom Out** Toolbar buttons.

5.5.5. Fine Gain Keypad<Alt + +>/<Alt + –>

These accelerators step the internal amplifier up or down by one increment of fine gain on the selected Detector, if it has a software-controlled amplifier. The new fine gain setting is shown on the Supplemental Information Line at the bottom of the screen. If the gain stabilizer is active, the display of the histogram data might not change.

The fine gain can also be set with **Acquire/Adjust Controls...** (Section 3.2.3), keyboard **<Alt + +>/<Alt + –>,** and **<Shift + Alt + +>/<Shift + Alt + –>**.

6. JOB FILES

The MAESTRO **.JOB** file consists of one or more lines of ASCII text representing a series of commands that can automate most of the functions described earlier in this manual. The details of the commands and the required syntax are given in this chapter. A **.JOB** file can be dispatched from the Run JOB File dialog accessed via the **Services**/**Job Control...** menu selection, or by including the name of the **.JOB** file on the command line when MAESTRO is first started (e.g., **MCA32 DEMO.JOB**).

.JOB files are used for the following types of functions:

1. Performing a repetitive task, such as running a sequence of experiments without user intervention.

2. Defining initial conditions at startup (useful in preloading presets after a power loss for the 916/916A/917/918/918A each time MAESTRO is run).

6.1. Job Command Functionality

.JOB files written for previous versions of MAESTRO (e.g. MAESTRO II or MAESTRO-PM) can be used. The text versions of these files will work on new Detectors as well as older models, with the exception of new commands and deleted commands.

6.1.1. Loops

MAESTRO has the ability to run repetitive loops. Furthermore, the current loop count can be included as a variable in any string, including filenames, program parameters, and text. Data can thus be stored with unique filenames and labeled with unique descriptions.

6.1.2. Errors

If an error is encountered in running a **.JOB** file, the execution of the file stops and control returns to MAESTRO. An error code appears in the **JOB Control...**. dialog box, as described in Section 4.4.1.

6.1.3. Ask on Save

If the **Ask on Save** (see **File/Settings...**) fields are turned on, MAESTRO will ask the corresponding questions when SAVE commands are executed in the **.JOB** file. This means that execution of the **.JOB** file will stop until the entry is made.

The ASK commands will also stop the **.JOB** file and prompt you to enter the requested information. The **.JOB** file will continue when you click on **OK** or press **<Enter>** on the dialog.

The input is used or stored immediately, before the next JOB instruction, except for the ASK_SPECTRUM command.

NOTE As is the case when saving with the menu or toolbar commands, if you choose **Cancel** when responding to an ask-on-save prompt, the entire save operation is canceled for that particular spectrum.

6.1.4. Password-Locked Detectors

When `.JOB` files are used with locked Detectors, the first time a destructive command is used on the locked Detector, you will be prompted for the password. Alternatively, you can use the ASK_PASSWORD command at the beginning of the JOB. From then on while the `.JOB` file executes,the password is retained and you will not receive a prompt. When the `.JOB` file quits, the password is forgotten.

6.1.5. .JOB Files and the New Multiple-Detector Interface

This release of MAESTRO allows you to open eight Detector windows and eight buffer windows at one time. However, as in previous MAESTRO releases, there is no limit on the number of Detectors that can be operated using `.JOB` files, and only one JOB at a time can run in a single instance of MAESTRO. The only difference in MAESTRO V6 is that a Detector window will open for each SET_DETECTOR command in the JOB, to a maximum of eight, and these windows will function as follows:

- JOB streams use the SET_DETECTOR command to open Detector windows. If eight Detector windows are already open and SET_DETECTOR is issued to open a ninth window, the oldest displayed Detector window will be closed without prompting.

- Once a Detector window is open, it cannot be closed within a JOB except by exceeding the eighth window open.

- On startup, MAESTRO will attempt to open with all Detector windows that were open the last time the program was shut down. Therefore, when running a JOB from the command line, if you wish to see only the Detector window(s) called from the JOB stream, use "-b" on the command line to force MAESTRO to open in a buffer window (see Section A.1). When running MAESTRO in interactive mode, be sure to close any windows you do not wish to see during the JOB execution.

- The same buffer window is always selected by the commands in a JOB, therefore, a JOB does not open multiple buffer windows.

- When you start a JOB, a Detector window will open for each Detector called by the **.JOB** file. The JOB filename will be echoed on the main MAESTRO title bar as well as on the title bars of all open spectrum windows.

6.2. Summary of JOB Commands

This section provides a quick reference to the JOB commands; for more detailed information, see Section 6.5. In the following descriptions, a variable filename or text is enclosed in "**...**" and a variable number is enclosed in <**...**>; anything enclosed in square brackets [**...**] is optional.

ASK_PASSWORD
Asks for password (used to lock Detectors).

BEEP <freq>,<duration>
Produces an audible sound of <freq> Hz, lasting <duration> milliseconds.

BEEP ID
A numerical ID is given based on a desired system event.

BEEP "String"
String can be a **.WAV** file or any event defined in the Registry.

CALL "file.job"
Executes another Job file as a subroutine.

CHANGE_SAMPLE
Provides sample changer hardware handshake.

CLEAR
Clears the data and descriptors in the active Detector.

DESCRIBE_SAMPLE "text"
Enters the text into the sample description to be saved with the spectrum.

EXPORT "filename"
This command executes the Export function with the filename specified.

FILL_BUFFER
Transfers the data from the active Detector to the buffer.

IMPORT “filename”
This command executes the Import function with the filename specified.

LOAD_LIBRARY “filename.extension”
Loads a nuclide library.

LOCK “Pwd”[”Name”]
This command locks the current Detector using “Pwd” as the password. If the optional “Name” parameter is missing, the Locked name defaults to “Job”.

LOOP <reps>...END_LOOP
Executes all the commands between LOOP and END, <reps> number of times.

LOOP SPECTRA...END_LOOP
This command executes the commands within the loop once for each spectrum stored in the Detector hardware.

MARK_PEAKS
Sets ROIs on all peaks in the active Detector or buffer window.

QUIT
Terminates this copy of MAESTRO.

RECALL “file.chn”
Reads the spectral data file to the buffer.

RECALL_CALIB “file.chn”
Loads the calibration data from the spectrum in the disk file to the buffer calibration parameters. The spectrum is not changed.

RECALL_ROI “file.roi”
Sets the ROIs from the table in the file.

REM [Text]
This line is a comment (remark) and is ignored during command processing.

REPORT “filename”
Writes the ROI-marked peak report to the disk filename or to the printer (PRN:).

RUN “program”
Executes an application program (**.EXE** by default).

RUN_MINIMIZED “program”
Same as the RUN command above, except that the application is run initially as an icon (minimized), rather than as a normal window.

SAVE “file.chn”
Saves the spectrum in the active Detector or the buffer in the disk file.

SAVE_ROI “file.roi”
Saves the table of ROIs in the active Detector or the buffer in the disk file.

SEND_MESSAGE “text”
Sends the text as a command to the Detector.

SET_BUFFER
Selects the buffer; same as SET_DETECTOR 0.

SET_DETECTOR <number>
Selects the Detector or buffer (0).

SET_NAME_STRIP “file.chn”
Sets the strip file.

SET_PRESET_CLEAR
Clears all presets in active Detector.

SET_PRESET_COUNT <n>
Sets the ROI Count preset to <n> counts.

SET_PRESET_INTEG <n>
Sets the ROI Integral preset to <n> counts.

SET_PRESET_LIVE <t>
Sets the live-time preset to <t> seconds.

SET_PRESET_REAL <t>
Sets the real-time preset to <t> seconds.

SET_PRESET_UNCERTAINTY <uncertainty limit>,<low channel>,<high channel>
Sets the statistical preset (DSPEC only) to the uncertainty.

SMOOTH
Smooths the spectrum in the buffer.

START
Starts the active Detector.

START_OPTIMIZE
Starts the optimize function for the detector (DSPEC only).

START_PZ
Starts the pole-zero function for the detector.

STOP
Stops the active Detector.

STOP_PZ
Stops the pole-zero function for the detector (DSPEC only).

STRIP <factor>,["file"]
Strips a spectrum file from the buffer.

UNLOCK "Pwd"
Unlocks the current Detector using "Pwd" as the password.

VIEW "i"
This command moves the "i"th stored spectrum to position 0.

WAIT [<seconds>]
Waits a fixed number of seconds (can be fractional) or until the active Detector stops counting (if no seconds specified).

WAIT "program"
Waits until the named program stops execution.

WAIT_AUTO
Waits until the optimize function is complete (DSPEC only).

WAIT_CHANGER
Waits until the sample-ready signal on the rear panel is present.

WAIT_PZ
Waits until the pole-zero function is complete (DSPEC only).

ZOOM <i>
Changes the size of the MAESTRO window to minimized, normal, or maximum.

ZOOM: <x,y,w,h>
Changes the position and size of the MAESTRO window to the stated values.

6.3. .JOB File Variables

Variables have been added to the **.JOB** file features to allow more flexibility and control of the JOBS. These variables are defined by the program or by operator entries. They can be used anywhere in the **.JOB** file.

For example:

```
$(FullPath)              = D:\USER\SOIL\SAM001.SPC
```

then:

```
$(FullBase)              = D:\USER\SOIL\SAM001
$(FileExt)               = SPC
$(FileDir)               = D:\USER\SOIL
$(ShortPath)             = SAM001.SPC
$(ShortBase)             = SAM001
```

The following variables are expanded in **.JOB** file strings:

$(FullPath)	Full pathname of the spectrum file
$(FullBase)	Full pathname of the spectrum without the "." and extension
$(FileExt)	File extension of the spectrum file without the " . "
$(FileDir)	Directory of the spectrum file without the last backslash (\)
$(McaDir)	MAESTRO directory without the last backslash
$(CurDir)	Starting (current) directory of MAESTRO
$(Loop)	Current value of the loop counter (zero based)
$(Loop1)	Loop counter plus 1
$(Bel)	ASCII bell character
$(CR)	ASCII carriage return character
$(FF)	ASCII form feed character

$(LF)	ASCII line feed character
$(ESC)	ASCII escape character
$(ShortPath)	Relative pathname of the spectrum file
$(ShortBase)	Relative pathname of the spectrum without the " . " and extension
$(Password)	Value entered in ASK_PASSWORD command
$(Owner)	Value entered in ASK_PASSWORD command

The filename variables are updated each time a READ operation is performed. The READ operations are:

LOAD
RECALL
RECALL_CALIBRATION
RECALL_ROI
STRIP

6.4. JOB Programming Example

A common operation that is ideal for a **.JOB** file is the collection of many consecutive sample spectra without user intervention. An example of this is the collection of a series of spectra to show the radioactive decay in a particular sample.

This process can be described as follows:

1. Set the Detector parameters, such as live time
2. Start the acquisition
3. Wait for the acquisition to stop
4. Integrate the nuclide peak
5. Record the peak area
6. Repeat this for the required number of samples

By looking at the list of steps above and the explanations below, the necessary commands can be determined and written down.

The first step in the process is to initialize the Detector to the condition needed of 1000 seconds live time. These are:

```
SET_DETECTOR 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
CLEAR
```

Note that all the presets were cleared before setting the live-time preset. This is to ensure that no previous presets (left over from other users) will interfere with this analysis.

Now start the acquisition and wait for completion of the live time.

```
START
WAIT
```

During this time the display manipulation keys are active so that the spectrum can be studied while collection is taking place.

Now move the spectrum from the Detector to the MAESTRO buffer. Select the buffer for the computational step.

```
FILL_BUFFER
SET_DETECTOR 0
```

In this step, the nuclide peak of interest is being marked by reading in an ROI file. This ROI file has been previously defined by looking at the spectrum and marking the peak (or the region around the peak). This ROI data is saved on the disk under the name **DECAYPK.ROI**. This **.JOB** file will work on different peaks or nuclides just by changing the ROI file.

```
RECALL_ROI "DECAYPK.ROI"
```

The peak areas of the marked peak or peaks is printed on the printer by this command:

```
REPORT "PRN"
```

This gives a list of the peak areas and count rates for the marked peak. If the library (**LIB.MCB**) has a peak near this energy then the peak identity will also be printed.

The set of instructions, as written so far, will only collect and report once. There are two ways to make the process repeat itself for a series of samples. The first and hardest is to write one set of the above instructions for every sample in the series. A much more efficient way is to use the LOOP command. To use this, put LOOP before CLEAR and END_LOOP after REPORT. The whole **.JOB** file now looks like this:

```
SET_DETECTOR 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
LOOP 10
```

```
CLEAR
START
WAIT
FILL_BUFFER
SET_DETECTOR 0
RECALL_ROI "DECAYPK.ROI"
REPORT "PRN"
SET_DETECTOR 1
END_LOOP
```

Note that an additional SET_DETECTOR 1 has been inserted after REPORT, *so the loop will operate on the desired Detector*.

Now select **Services**/**Job Control**. Click once on an existing **.JOB** filename then click the **Edit File** button. This will display the contents of that file in Windows Notepad. You can then *overwrite* the existing instructions with the above set of commands. However, save the new instructions to a new file named **SAMPDATA.JOB** using the **File**/**Save As** function (do not use **Save** or the original file will be lost).

This new **.JOB** file can then be executed in MAESTRO from the **Services** menu by selecting **Job Control...** to display the **Run JOB File** dialog. Select **SAMPDATA.JOB** from the list of files and click on **Open**.

6.4.1. Improving the JOB

This **.JOB** file can be improved by adding a save step for each spectrum collected. This is done by inserting the SAVE command in the **.JOB** file. The spectrum sample description is also entered here. This sample description is saved with the spectrum and is printed by the REPORT command. Note that the loop counter (the ??? in the **.JOB** file text) is used in the SAVE and DESCRIBE_SAMPLE commands.

The new **.JOB** file is:

```
SET_DETECTOR 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
LOOP 10
CLEAR
START
WAIT
FILL_BUFFER
SET_DETECTOR 0
DESCRIBE_SAMPLE "This is sample ???."
SAVE "DECAY???.CHN"
RECALL_ROI "DECAYPK.ROI"
```

```
REPORT "PRN"
SET_DETECTOR 1
END_LOOP
```

Spooling the report might take some time. To overlap the data collection with the analysis, the logic of the **.JOB** file needs to be modified to restart the acquisition after the data have been moved to the buffer.

NOTE All of the analysis is performed on the buffer spectrum so the Detector spectrum can be erased and the next one started.

Insert CLEAR and START after FILL_BUFFER, as shown here:

```
SET_DETECTOR 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
CLEAR
START
LOOP 10
WAIT
FILL_BUFFER
CLEAR
START
SET_DETECTOR 0
DESCRIBE_SAMPLE "This is sample ???"
SAVE "DECAY???.CHN"
RECALL_ROI "DECAYPK.ROI"
REPORT "PRN"
SET_DETECTOR 1
END_LOOP
```

These few examples have shown some of the possibilities of the JOB language in MAESTRO.

6.5. JOB Command Details

ASK_PASSWORD

This is used to define the password and owner to be used in the **.JOB** file. Passwords can be used to lock an unlocked detector, unlock and use one that is locked, or lock one for the duration of the job and then unlock it. The actual lock/unlock is done with LOCK and UNLOCK, respectively.

This command is to set the internal password variable, **$(PASSWORD)**, to the user input so the password will be available for use in the JOB. The **$(OWNER)** variable is only used when locking detectors. Following is an example:

```
.
.
.
ASK_PASSWORD
LOCK $(password),$(owner) [,"Name"]
.
.
.
```

BEEP <freq>, <duration>

This command produces an audible tone at a pitch of <freq> Hertz, lasting for <duration> milliseconds. For example, BEEP 1000,1000 is a nicely annoying alarm, while BEEP 50,50 is a short "burp."

This command is disabled by Windows if any "sound" software is used. It should be used with caution if other sound-producing software is running.

BEEP ID

A numerical ID is given based on a desired system event. For example, **BEEP** 7 will exit Windows.

ID	Event
0	Beep Speaker
1	Default Beep
2	Start Windows
3	Asterisk
4	Exclamation
5	Critical Stop
6	Question
7	Exit Windows

BEEP "String"

String can be a **.WAV** file or any event defined in the Registry.

CHANGE_SAMPLE

This command is used to control the **CHANGE SAMPLE** output and **SAMPLE READY** input BNC signals on the rear panel of MCBs with sample-changer control (e.g., DSPEC, 919E), and is intended to initiate a hardware handshake sequence for advancing a sample changer. The SET_OUTPUT_HIGH command is sent to the currently selected Detector, then the sample-ready status is monitored (for at least 120 seconds) until the input is low, and finally the SET_OUTPUT_LOW command is sent and input is monitored until it returns to the high level again before proceeding.

Note that if the sample changer controls are not able to make the **SAMPLE READY** input go high very soon after the **CHANGE SAMPLE** signal is set (i.e., the normal state of the **SAMPLE READY** is low; it is expected to go high immediately after the **CHANGE SAMPLE** condition is set and remain high while the sample changer is moving, and returns to low when the sample changer is at its new position), it might be necessary to use the SEND_MESSAGE command to send a SET_OUTPUT_HIGH command, then pause (with WAIT or some other time-consuming command), and then send the CHANGE_SAMPLE command. The following example demonstrates this:

```
SET_DETECTOR 1
LOOP 5
CLEAR
START
WAIT
FILL_BUFFER
SEND_MESSAGE "SET_OUTPUT_HIGH"
SET_Detector 0
SAVE "MONTE???.CHN"
SET_DETECTOR 1
CHANGE_SAMPLE
END_LOOP
```

CLEAR

This command clears (erases) the spectral data, real time, and live time for the selected Detector. The presets are not changed. This command has the same function as the **Clear** function under the **Acquire** menu. The command would logically be preceded by the SET_DETECTOR commands as follows:

```
.
.
.
SET_DETECTOR 1
CLEAR
.
.
.
```

DESCRIBE_SAMPLE "description"

This command accepts a 63-character description of the sample being analyzed. This description is saved with the spectrum using the SAVE command function, and is included in the REPORT printout. This performs the same function as the **Sample Description...** function under the **Services** menu.

The loop count value can be included in any text by typing three question marks (???) in the text where the loop count is to be inserted. The loop count replaces "???" wherever it appears.

EXPORT "filename"

This command executes the Export function with the filename specified. The remainder of the options are defined on the Export tab under **File**/**Settings...**. The filename can include any of the variables defined in Section 6.3.

FILL_BUFFER

This command transfers the active Detector data to the buffer. This command has the same function as **Copy to Buffer** under **Acquire**.

IMPORT "filename"

This command executes the Import function with the filename specified. The remainder of the options are defined on the Import tab under **File**/**Settings...**. The filename can include any of the variables defined in Section 6.3.

LOAD_LIBRARY "filename.extension"

This command loads the specified **.LIB** or **.MDB** nuclide library, and duplicates the function of **Library File** under the **Services** menu. The old MAESTRO library format (**.MCA**) is no longer supported.

LOCK "Pwd"[,"Name"]

This command locks the current Detector using "Pwd" as the password. If the optional "Name" parameter is missing, the Locked name defaults to "Job".

This password is retained in the **.JOB** file and used with any JOB commands (except SEND_MESSAGE) so the operator does not need to reenter the password.

LOOP <repetitions> **... END_LOOP**

This command pair executes multiple times all the commands between LOOP and END_LOOP. The number of execution times is specified by <repetitions>. Each command must be given on a separate line. A value of 0 executes once. A LOOP with no END_LOOP statement executes once.

The loop count value can be included in any text by typing three question marks (???) in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear.

NOTE Spaces should be included only in the text and not in the filename. Filenames with spaces cannot easily be used by DOS commands.

The following is an example:

```
SET_DETECTOR 1
SET_PRESET_LIVE 20
LOOP 3
SET_Detector 1
CLEAR
START
WAIT
FILL_BUFFER
SET_DETECTOR 0
SAVE "TEST???.CHN"
END_LOOP
```

The above commands run three 20-second acquisitions and store the data on a disk in files **TEST001.CHN**, **TEST002.CHN** and **TEST003.CHN**.

LOOP SPECTRA...END_LOOP

This command executes the commands within the loop once for each spectrum stored in the Detector hardware. This command only works for hardware that supports Field Mode.

MARK_PEAKS

This command does a Mariscotti-type peak search on the spectrum in the active Detector or buffer window, and duplicates the **Calculate/Peak Search** command. The peak-search sensitivity is selected in **Calculate/Settings...**. Each peak found is marked as an ROI. If the buffer is calibrated, the width of the ROI is three times the calculated FWHM of the peak. If the buffer is not calibrated, the width of the ROI equals the width of the peak as determined by **Peak Search**. Overlapping or close peaks might have contiguous ROIs. Existing ROIs are not cleared, therefore, you might wish to clear them before performing this analysis. This command has the same function as **Peak Search** in the **Calculate** menu.

The following is an example of the MARK_PEAKS command used with REPORT:

```
.
.
.
MARK_PEAKS
REPORT "TESTDAT.RPT"
.
.
.
```

The above procedure does a peak-search-directed report of nuclides found, as listed in the library currently in memory, then writes to disk an **ROI Report** for the peaks found.

QUIT

This command unconditionally terminates the MAESTRO program and returns control to Windows.

RECALL "file.chn"

This command reads a disk filename to the buffer. The disk file must be in the format created by SAVE. Any DOS filename, including the drive and subdirectory, can be used. The resulting memory size of the buffer is the same as the memory size of the file. The file, live time, and real time are restored. If the spectrum file has calibration information, the calibration parameters are used to set the calibration for the buffer.

This command has the same function as **Recall...** under the **File** menu.

The loop count value can be included in the above filename, as in any text, by typing three question marks (???) in the text where the loop count is to be inserted. The loop count replaces "???" wherever they appear.

RECALL_CALIB "file.chn"

This command loads only the buffer calibration parameters from the calibration data stored with a spectrum.

This command can be used in generating reports that include library isotope identification. The following is an example:

```
.
.
.
RECALL_CALIB "CALIB001.CHN"
MARK_PEAKS
REPORT "NEWDATA.RPT"
.
.
```

The report **NEWDATA.RPT** includes isotope identification using the energy calibration contained in **CALIB001.CHN**.

RECALL_ROI "file.roi"

This command marks the ROI channels in the buffer or Detector to conform to the table in the disk file, created by SAVE_ROI or **Save File..**. under the **ROI** menu. The data contents of the Detector or buffer are not altered by this operation. The previous ROIs are cleared.

This command has the same function as **Recall File..**. under **ROI**. It can be used in generating reports that look for specific isotopes (library-directed as opposed to peak-search-directed). For example, a calibration spectrum is run containing ^{57}Co and ^{137}Cs, and ROIs

marked on the 122-keV and 662-keV peaks. The calibration is saved as spectrum file **COBCS.CHN** and as ROI file **COBCS.ROI**.

The command sequence is:

```
.
.
.
RECALL_CALIB "COBCS.CHN"
RECALL_ROI "COBCS.ROI"
REPORT "COBCS.RPT"
.
.
.
```

These commands report the values only for the 122-keV and 662-keV peaks. Compare with the example for MARK_PEAKS.

As usual, the loop count value can be included in any text by typing three question marks (???) in the text where the loop count is to be inserted. The loop count replaces "???" wherever it appears.

REM [Text]

This line is a comment (remark) and is ignored during command processing. The REM command allows entering descriptive comments into script files or disabling commands during testing of scripts.

REPORT "filename"

This command produces a list of areas, activities, and peak shapes for all the ROIs marked in the spectrum. See **File/ROI Report** (Section 4.1.7) for more information on the report format and contents. The ROI data is presented in either columns or paragraphs, according to the format most recently selected in the ROI Report dialog (therefore, you can choose a format before executing the JOB file). If you do not specify a filename, the report will be sent to the default Windows printer for this PC. If you specify a filename, the report will be sent to an ASCII text file that can be used by other programs or printed later. The loop count value can be included in the filename by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" in the filename. The filename can include any of the variables defined in Section 6.3.

RUN "program"

This command executes an application named "program". This is typically an **.EXE** or **.PIF** filename. Note that the program might not run to completion before the **.JOB** file exits, unless it is run at higher priority or the WAIT "program" command is used.

RUN_MINIMIZED "program"

Same as the **RUN** command above, except that the application is run initially as an icon (minimized), rather than as a normal window.

SAVE "[d:][\path\]file[.chn]"

This command, which has the same function as **Save As...** under the **File** menu, saves the currently active buffer to a disk file. The disk filename (in quotation marks) can be any valid filename; the drive [**d:**], path [**\path**] and extension [**.CHN**] are optional. If an extension is not supplied, the default extension is automatically **.CHN**. Also, the current drive and directory are used by default when the optional path specification is not supplied. The loop count value can be included in the filename by typing three question marks (???) in the text where the loop count is to be inserted. The loop count replaces "???" wherever it appears.

Any **Ask on Save** questions defined in **File/Settings...** are asked each time a SAVE command is executed. This stops execution of the **.JOB** file until the question is answered. Note that if you choose **Cancel** for an ask-on-save prompt, the entire save operation is canceled for that particular spectrum.

The real time, live time, start of acquisition, and, if available, calibration data, Detector description, and sample description, are stored with the spectrum.

SAVE_ROI "[d:][\path\]file[.roi]"

This command, which has the same function as **Save File...** under the **ROI** menu, saves a table of channel numbers that have the ROI set for the active Detector or buffer in a disk file. The contents of the spectrum are not altered by this operation. The disk filename (in quotation marks) can be any valid filename, with optional elements as described for the SAVE command, above. The default extension is **.ROI**. The loop count value can be included in the filename by typing three question marks (???) in the text where the loop count is to be inserted. The loop count replaces "???" wherever it appears.

SEND_MESSAGE "command"

This command is used to send NIM-488 commands to the active Detector. This can be used to perform any operations of the Detector that are desired. The text must be in the syntax expected by the Detector. If the response from the Detector does not end with a command-accepted message, this command will exit with error.

If a user attempts to use this command to send destructive commands to a locked Detector, the JOB will fail. Use UNLOCK to unlock the Detector before using SEND_MESSAGE, and LOCK afterward.

The following is an example of using this command to set the fine and coarse gain to a total value of 50 (the product of the fine [= 0.5] and coarse [= 100] gains):

```
.
.
.
SET_DETECTOR 1
STOP
CLEAR
SEND_MESSAGE "SET_GAIN_FINE 2048"
SEND_MESSAGE "SET_GAIN_COARSE 100"
.
.
.
```

SET_BUFFER

Selects the buffer; same as SET_DETECTOR 0.

SET_DETECTOR <number>

This selects the active Detector or the buffer. The Detector number can be 1 to 999 according to the Detector configuration, or 0 for the buffer. Also, SET_DETECTOR without an argument is used to switch to the previously selected Detector. If a Detector is selected that does not exist, no change is made. The Detector number is the number shown on the Toolbar and the Detector pick list.

The JOB processor expects one or more numerals as the argument to this command, entered with or without quotation marks (e.g., you can enter the numerals 1000 or the string "1000"). The JOB processor will also accept the loop counter as an argument to the function *as long as it is set in quotation marks*. For example, you could use "$(loop1)" to sequence through the detector list, provided the detector list is in numerical sequence.

This command (for values 1 to 12) has the same function as **<Ctrl+ F1>** through **<Ctrl+ F12>**. For value 0 or no argument at all, it duplicates the **Detector/Buffer** toggle under the **Display** menu, **<F4>**, and **<Alt+ 6>**.

See also the notes on SET_DETECTOR and the new MAESTRO multi-detector interface in Section 6.1.5.

SET_NAME_STRIP "file.chn"

This command can be used before STRIP to select a disk filename to be used subsequently by the STRIP command. (It is not necessary to use this command because the filename can be supplied as part of the STRIP command itself; however, the command is included in the repertoire for backward compatibility with MAESTRO II command files.) No other action is performed by this command.

SET_PRESET_CLEAR

This command clears the presets for the active Detector. The clearing should be done to ensure that unwanted presets are not used by the Detector when the Detector is started. Presets can only be changed when an MCB is not counting.

The Detector and Detector should be selected by the SET_DETECTOR commands before the SET_PRESET_CLEAR command is given, as in the following:

```
.
.
.
SET_DETECTOR 1
STOP
SET_PRESET_CLEAR
START
.
.
.
```

SET_PRESET_COUNT <counts>

This command sets the ROI peak count preset for the active Detector. The preset is set to the entered value. With this preset condition, the Detector stops counting when any ROI channel's content reaches this value. If no ROIs are marked in the Detector, that Detector never meets this condition. This command has the same function as the **ROI Peak** field on the Presets tab under **Acquire**/**MCB Properties**; refer to Section 4.2.7 for additional information.

The JOB processor expects one or more numerals as the argument to this command, entered with or without quotation marks (e.g., you can enter the numerals 1000 or the string "1000"). The JOB processor will also accept the loop counter as an argument to the function *as long as it is set in quotation marks*. For example, you could use the loop counter to collect a series of spectra with increasing ROI peak counts by appending zeroes to the loop counter to obtain 1000 counts, then 2000, and so on.

SET_PRESET_INTEGRAL <counts>

This command sets the ROI Integral count preset value for the active Detector. The preset is set to the entered value. With this preset condition, the Detector stops counting when the sum of all counts in all channels marked with an ROI reaches this limit. If no ROIs are marked in the Detector, the Detector never meets this condition. This command has the same function as the ROI Integral field on the Presets tab under **Acquire**/**MCB Properties**; refer to Section 4.2.7 for additional information.

The JOB processor expects one or more numerals as the argument to this command, entered with or without quotation marks (e.g., you can enter the numerals 1000 or the string "1000"). The JOB processor will also accept the loop counter as an argument to the function *as long as it is set in quotation marks*. For example, you could use the loop counter to collect a series of spectra with increasing ROI integral counts by appending zeroes to the loop counter to obtain 1000 counts, then 2000, and so on.

SET_PRESET_LIVE <seconds>

This command sets the Live Time preset for the active Detector. The preset is set to the entered value. With this condition, the Detector stops counting when the live time reaches this limit, unless some other preset condition occurs first. The live time is the real time minus the dead time. This command has the same function as the Live Time field on the Presets tab under **Acquire/MCB Properties**; refer to Section 4.2.7 for additional information.

The JOB processor expects one or more numerals as the argument to this command, entered with or without quotation marks (e.g., you can enter the numerals 1000 or the string "1000"). The JOB processor will also accept the loop counter as an argument to the function *as long as it is set in quotation marks*. For example, you could use the loop counter to collect a series of spectra with increasing ROI integral counts by appending zeroes to the loop counter to obtain 1000 counts, then 2000, and so on.

SET_PRESET_REAL <seconds>

This command sets the Real Time preset for the active Detector. The preset is set to the entered value. With this preset condition, the Detector stops counting when the real time reaches this limit, unless some other preset condition occurs first. This command has the same function as the Real Time field on the Presets tab under **Acquire/MCB Properties**; refer to Section 4.2.7 for additional information.

The JOB processor expects one or more numerals as the argument to this command, entered with or without quotation marks (e.g., you can enter the numerals 1000 or the string "1000"). The JOB processor will also accept the loop counter as an argument to the function *as long as it is set in quotation marks*. For example, you could use the loop counter to collect a series of spectra with increasing ROI integral counts by appending zeroes to the loop counter to obtain 1000 counts, then 2000, and so on.

SET_PRESET_UNCERTAINTY <uncert limit>,<low chan>,<high chan>

For the DSPEC only, this sets the statistical preset to the uncertainty based on the counts in the region between the low and high channels. See Section 4.2.7 and Eq. 6, page 78, for the details of the calculation.

SMOOTH

This command smooths the data in the active buffer window. Its function is the same as **Smooth** under the **Calculate** menu. A five-point, area-preserving, binomial smoothing algorithm is used. The original contents of the buffer are lost.

START

This command initiates data collection in the selected Detector. This function is the same as **Start** under the **Acquire** menu.

START_OPTIMIZE

For the DSP-type only, this starts the optimize function for the detector.

START_PZ

This starts the pole-zero function for the detector. It is automatically included in the optimize function. (Not supported on all MCBs.)

STOP

This command stops data collection in the active Detector. If the Detector has already been stopped, no operation occurs. This command has the same function as **Stop** under the **Acquire** menu.

STOP_PZ

This stops the pole-zero function for the detector. Note that the pole-zero function is not complete when this is used. The pole-zero function should be allowed to complete automatically. (Not supported on all MCBs.)

STRIP <factor>, [”file.chn”]

This command strips the disk spectrum specified in the SET_NAME_STRIP command or in the command itself (either way is acceptable; the filename is optional in this command) from the spectrum in the buffer and stores the results in the buffer. The disk and buffer spectra must be the same size. The disk spectrum can be scaled up or down by <factor> (a constant) or, if <factor> is zero, by the ratio of the live times of the two spectra.

UNLOCK “Pwd”

Unlocks the current Detector using “Pwd” as the password.

VIEW “i”

This command moves the “i”th stored spectrum to position 0.

WAIT [<seconds>]

This command suspends execution of the JOB until either the active Detector stops counting (in the case where the <seconds> argument is not included), or for a fixed number of seconds (which can be fractional).

NOTE The "wait for end of acquisition" form of the command (i.e., no argument) will suspend the JOB indefinitely if there are no preset conditions that can be satisfied (i.e., if acquisition proceeds indefinitely).

WAIT "program"

This command suspends execution of the JOB until the named program stops execution. If the program does not stop, the JOB will not continue.

WAIT_AUTO

For the DSPEC only, this waits until the optimize function is complete.

WAIT_CHANGER

For MCBs with sample-changer controls (e.g., DSPEC, 919E), this waits until the sample-ready signal on the rear panel is present. It is used in conjunction with the SEND_MESSAGE function for more control over the sample changer than is provided by the CHANGE_SAMPLE command.

WAIT_PZ

This waits until the pole-zero function is complete. (Not valid on all MCBs.)

ZOOM <i>

Changes the size of the MAESTRO window. Selects one of icon, normal, or maximum according to the argument. The arguments are:

–1	=	Minimize (icon on Taskbar)
0	=	Normal (size determined by last use)
+1	=	Maximize (full screen)

ZOOM: <x,y,w,h>

Changes the position and size of the MAESTRO window. The arguments are:

x	=	x position of upper left corner of window (0 is left)
y	=	y position of upper left corner of window (0 is top)
w	=	width of window in pixels, starting at x and going right
h	=	height in pixels, starting at y and going down

Since these arguments are in pixels, experimentation is the best way to determine the desired size.

7.1. WINPLOTS

This program makes a hardcopy output of any type of ORTEC spectrum file in a fixed format with many user-set optional variations (such as grid lines) available. The plotting output devices include the full range of graphics-capable printing devices supported by Windows (i.e., hardcopy is not limited only to plotters). WINPLOTS allows you to select and set up the printer. In the interactive mode, a preview of the spectrum plot is automatically displayed on the screen and updated as changes are made to the display parameters. The operator can select the start and stop channels or energy range for the plot, the printer to be used, whether the plot will be in logarithm mode or linear mode, and whether to specify the scale maximum in linear mode or use automatic scaling. If a color printer is used, the colors of the different parts of the plot can be selected.

The sample, detector, and acquisition descriptions in the file can be plotted or suppressed. ROIs can be plotted when stored in the spectrum (`.SPC`) file or in a separate `.ROI` file.

To start WINPLOTS, click on **Start** on the Windows Taskbar, then **Programs**, **MAESTRO 32**, and **WinPlots** (see Fig. 106). WINPLOTS can also be run in command-line mode for use in `.JOB` files, or directly from other Windows programs (see Section 7.1.3). In this mode, the settings can be specified or the defaults can be used.

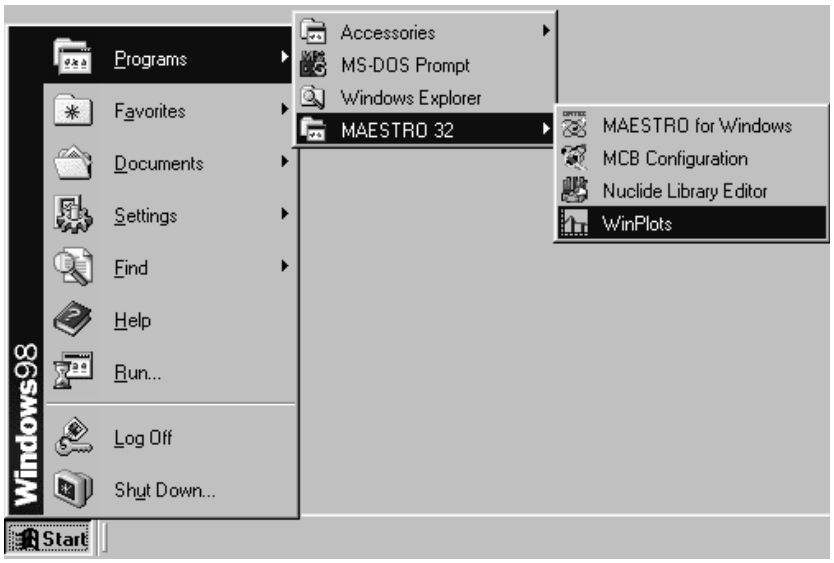


Fig. 106. Starting WINPLOTS.

The spectrum files are associated with WINPLOTS by the installation program, so double-clicking on a spectrum filename within Windows Explorer will start WINPLOTS and display that spectrum.

The main WINPLOTS display is shown in Fig. 107.

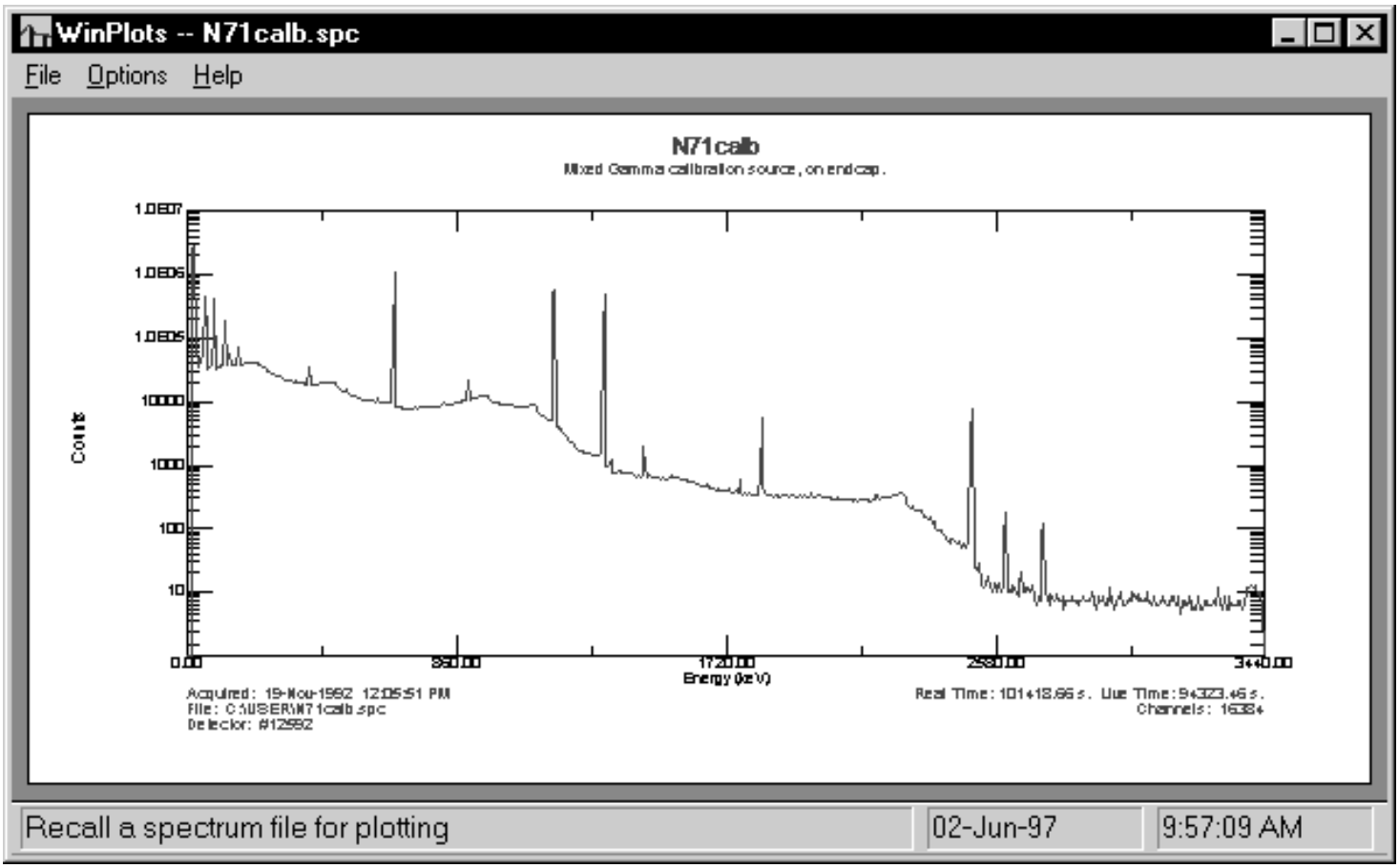


Fig. 107. The Main WINPLOTS Display.

7.1.1. File

Figure 108 shows the **File** menu. These menu items select the spectrum and ROI to be displayed, read and write the settings file, and actually make the plot.

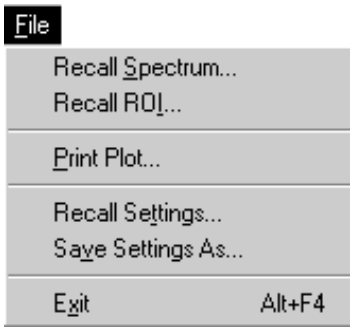


Fig. 108. The File Menu.

Once a file has been selected using the **Recall Spectrum...** function (see the file-recall dialog shown in Fig. 109), it is automatically previewed using the current settings. This is the exact plot that will be printed. There are minor differences between display and printer fonts and colors.

The sample description, format, and number of channels are shown at the bottom of the dialog to aid in selecting the correct file.

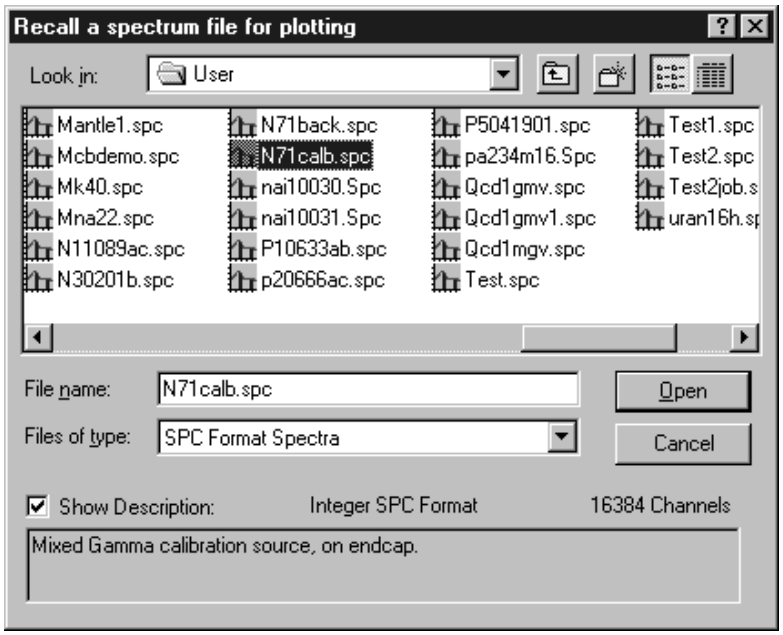


Fig. 109. The Recall Spectrum File for Plotting Dialog.

Figure 110 shows the **Recall a settings file** dialog. All of the settings specified on the **Options**/**Plot...** dialog can be saved in the settings file. The file is saved in the **Save Settings** menu item. Various groups of settings can be saved and recalled here to make the desired plots or to be used in the command line mode.

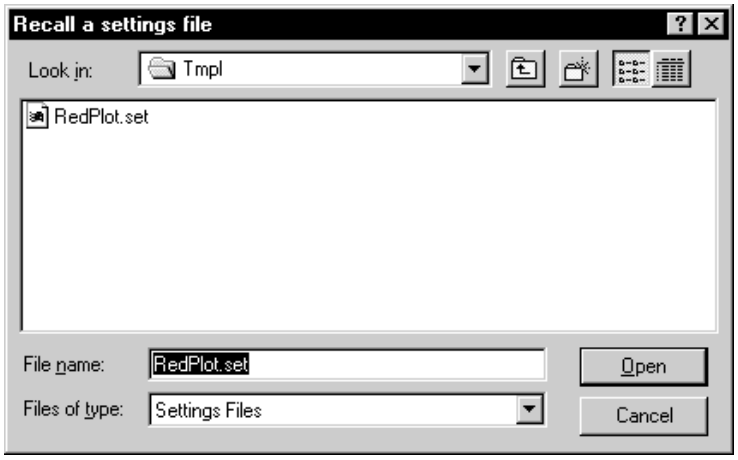


Fig. 110. The Recall a Settings File Dialog.

The **Print Plot...** dialog is shown in Fig. 111. The printer can be selected here from the list of available Windows printers. The **Properties** button displays a dialog for setting the printer properties, and is different for each printer. The number of copies can be selected to make multiple copies. This number is reset to 1 after each print session.

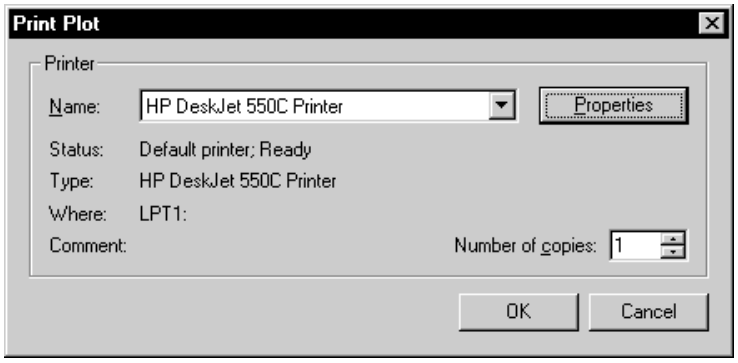


Fig. 111. The Print Plot Dialog.

7.1.2. Options

The **Options** menu is shown in Fig. 112. These menu items control the plot settings and WINPLOTS operation.

Fig. 112. The Options Menu.

7.1.2.1. Plot...

The **Plot Options** dialog is shown in Fig. 113. These settings are all stored in the default settings file and reloaded when WINPLOTS is next started. The **Title** is printed at the top of every plot (just above the sample description). If no title is specified, a default title composed of the spectrum and ROI file names is generated. The **Printer** is selected from the list of available printers in Windows.

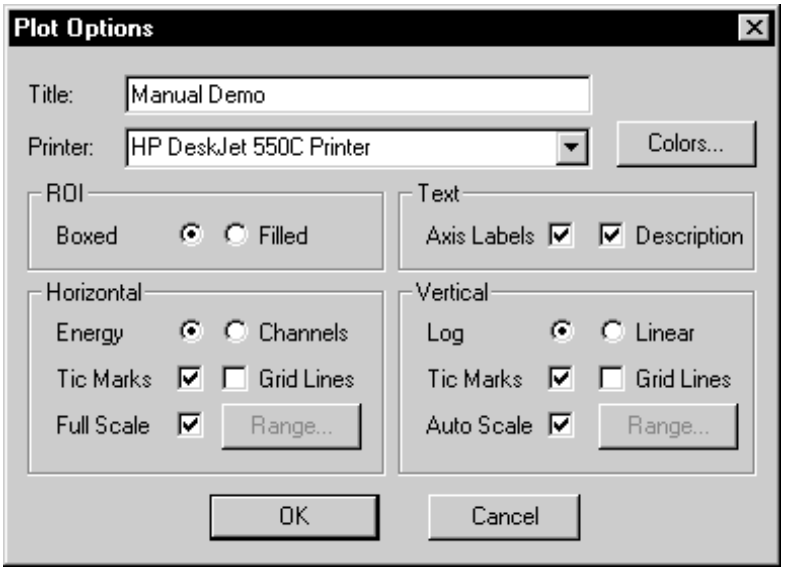


Fig. 113. The Plot Options Dialog.

If the printer supports color printing, the **Colors...** button will be enabled. Clicking on it will display the Color Options dialog (Fig. 114). If you want monochrome prints from a color printer, mark the **Monochrome** box. The five different plot areas can have different colors. Select the desired color from the droplist for each area. These are the Windows colors defined for the selected printer and might not duplicate the actual colors printed.

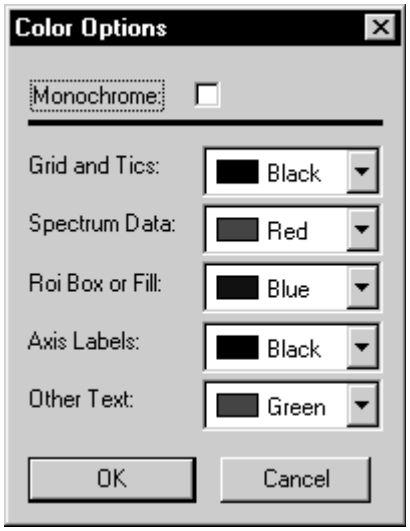


Fig. 114. The Color Options Dialog.

ROI

The ROIs can be **Boxed**, that is, represented as "boxes" drawn from the start to the stop channel (or energy) and from the baseline to above the spectrum. The **Filled** selection will "fill" the region under the spectrum data with a cross hatch. It is not completely filled in and does not extend above the data.

Text

The **Axis Labels** and the text **Description** from the file can be printed. The description includes the sample, detector, and acquisition description.

Horizontal

If the spectrum to be plotted is calibrated, the plot can be either in **Energy** or **Channel** numbers. If the spectrum is not calibrated, this value is set to channel and cannot be altered.

Tic Marks (small lines indicating the scale on the axes) can be included. Including them makes the plot more readable. **Grid Lines** can also be included. The grid lines are lines across the complete width of the plot at the major tic marks.

The plot can either be the complete spectrum or any part of the spectrum. Unmarking **Full Scale** will enable the **Range** button. Selecting **Range** will open the dialog shown in Fig. 115 so you can set the limits for the plot. The range of the plot can be either in **Channels** or **Energy** (independent of the plot labeling). In order to easily compare spectra, the energy can be set to values below the first channel in the spectrum. In this case the data below channel 0 are plotted as 0.

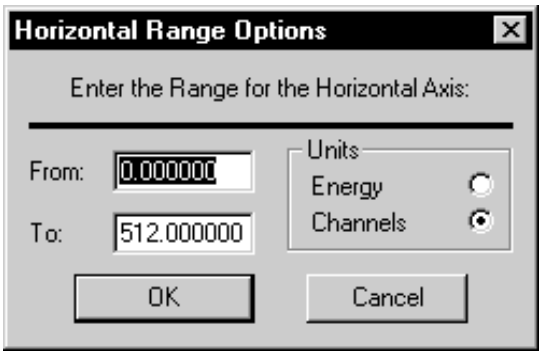


Fig. 115. Horizontal Range Options Dialog.

Vertical

One of the two choices, **Log** and **Linear**, can be selected by clicking on the appropriate radio button. The linear scale is set by clicking on **Range...**.

Tic Marks (small lines indicating the scale on the axes) can be included. Including them makes the plot more readable. **Grid Lines** can also be included. The grid lines are lines across the complete height of the plot at the major tic marks.

When **Auto Scale** is selected, the plot vertical axis is adjusted so that the largest count in the spectrum is near the top of the plot region.

When **Auto Scale** is clicked off, the **Range** button is enabled. Clicking on **Range** will display the dialog shown in Fig. 116. The value entered will be the value for the top of the plotted region. Any counts above this value will be plotted at this value.

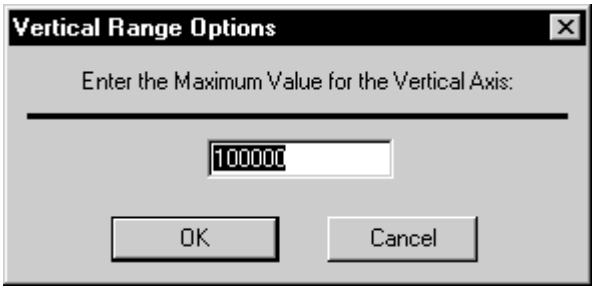


Fig. 116. Vertical Range Options Dialog.

7.1.3. Command Line Interface

The WINPLOTS Command Line Interface will support options available in the interactive mode as shown below:

WINPLT32<spectrum> -R <roi_file> -S <set_file> -P

where:

<spectrum>	Specifies the spectral data file (**.SPC**, **.An1**, or **.CHN**). The extension must be included.
-R <roi_file>	Specifies the **.ROI** file. The extension must be included.
-S <set_file>	Specifies the settings file. The extension must be included.
-P	Causes the program to print the plot and exit automatically. Used mainly in **.JOB** files or the Export function.

7.2. Nuclide Library Editor

MAESTRO V6 now uses the GammaVision Library Editor to create and edit library files, which are used in the peak search and report functions for the quantitative identification of and activity calculations for spectral components according to calibrated peak energy.

The new library editor allows you to work with both the MAESTRO/GammaVision **.LIB** format and with **.MDB**-format libraries created by ORTEC's NuclideNavigator products. (The old MAESTRO library format [**.MCA**] is no longer supported.) The library files are organized by nuclide, then by the nuclide's peaks. Library data include the nuclide name, half-life, and half-life uncertainty. Nuclide names can be any combination of eight characters, but must be consistent throughout all files. The library peak data include the energies and branching ratio or gammas/disintegration for each energy. The default file extension is **.LIB**.

At startup, MAESTRO automatically attempts to load the library last loaded. Thereafter, this *working library* can be replaced at any time with **Library/Select File...**. The library stays resident in memory after it has been loaded.

In the analysis report, the nuclides are listed in the order they are in the library. The size of a working library is limited to 65,000 bytes for any combination of nuclides and peaks (e.g., about 100 nuclides with 1900 peaks or 200 nuclides with 1600 peaks). Master or reference libraries (e.g., **MASTER.LIB** from A53-BI or **MASTER.MDB** from NuclideNavigator), from which the working libraries are built, can be any size.

NOTE Some old libraries might need to be rebuilt by copying the complete library to a new library as described in the following section. If you receive a"**Can't read library**" error, the library should be rebuilt.

Figure 117 shows the library Editing dialog.

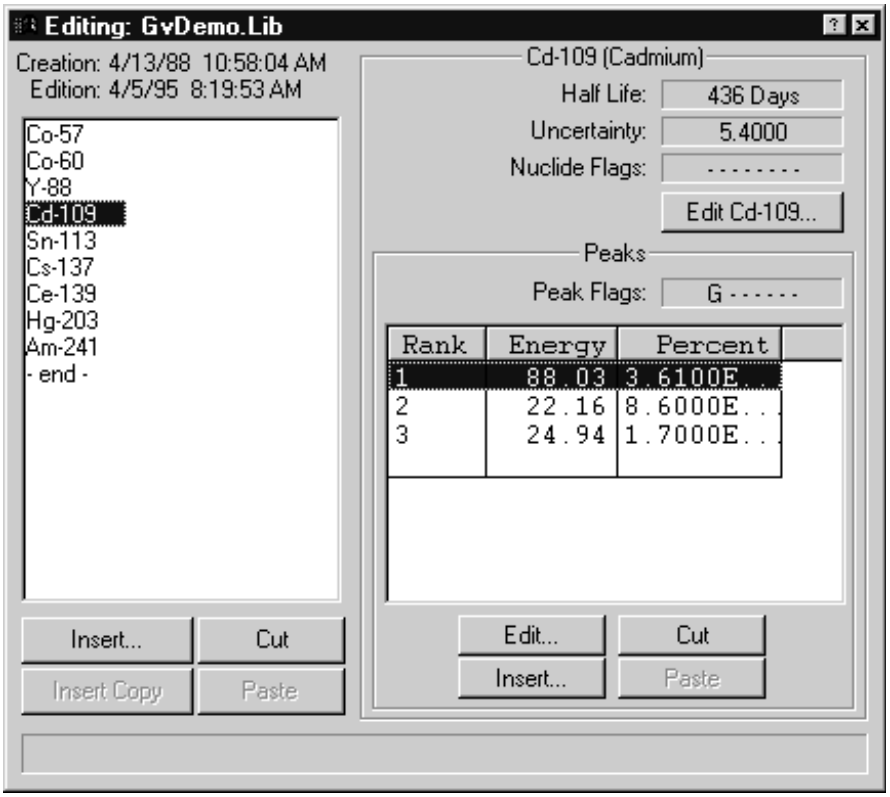


Fig. 117. Editing Library Dialog.

The control menu is shown in Fig. 118; click on the Title Bar icon to open it. This menu contains several of the commands necessary to create and edit library files.

Fig. 118. Library Edit Dialog Control Menu.

7.2.1. Copying Nuclides From Library to Library

To copy nuclides from one library to another library — for example, to make a working library from a master library — click on the **Edit** window's control menu and select **Show Master Library...**. This will open a standard file-open dialog. Choose the desired file and click on **Open**. Both libraries will be displayed side by side, as illustrated in Fig. 119.

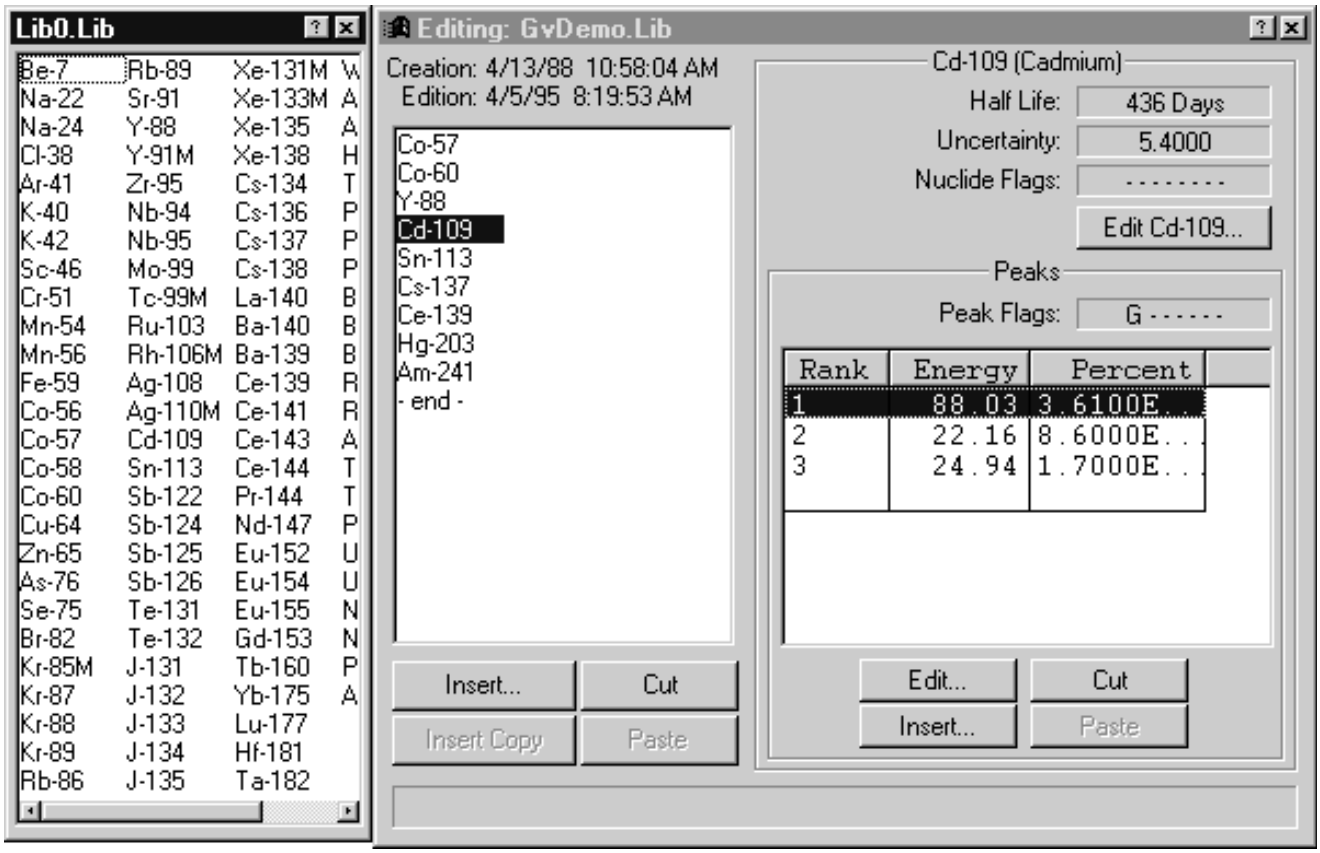


Fig. 119. The Master Library (left) and Library Editing Dialog (right).

To copy a nuclide from the master library to the working library:

1. Go to the master library list and click once on the nuclide of interest. This will activate the gray **Insert Copy** button at the bottom of the Editing dialog's nuclide list, and change its label to **Insert** plus the name of the nuclide.

2. Now, in the Editing dialog, locate the nuclide immediately *below* the desired insertion position, click on it once, then click on **Insert [nuclide name]**. This will insert the nuclide and display its peak list on the right.

3. Double-clicking on a nuclide in the master library will add it to the working library, inserting it immediately above the currently highlighted nuclide in the list.

7.2.2. Creating a New Library Manually

Open the control menu and click on **New**. This will clear the Editing dialog so nuclides can be entered manually. Click on the **Insert...** button to open the Insert Library Nuclide dialog, shown in Fig. 120. Enter the **Nuclide Name** and **Half Life** and click on **OK**.

Now, at the bottom of the (right-hand) peak list, click on **Insert...** to open the Edit Library Peak dialog (Fig. 124). Enter the energy of the gamma ray and the branching ratio of the peak.

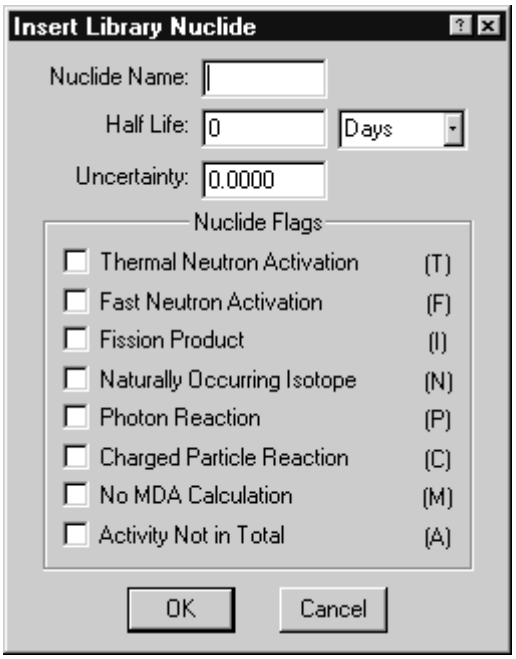


Fig. 120. Insert a Nuclide into a Library.

7.2.3. Editing Library List Nuclides

To edit the information about a nuclide in the working library:

1. Click on the nuclide to highlight it. The **Edit...** button (in the upper right of Fig. 117) will change to **Edit** plus the name of the nuclide, as shown in Fig. 121.

2. Click on **Edit [nuclide]...**. This will open the Edit Library Nuclide dialog (Fig. 122). The **Nuclide Name**, **Half Life**, **Uncertainty**, and **Nuclide Flags** will already be listed.

Fig. 121. Ready to Edit this Nuclide.

The **Uncertainty** is a single number that represents the uncertainty (2 sigma or 95% confidence level) in the values entered for this nuclide. It is added in quadrature to form the total uncertainty on the final report. The **Uncertainty** value should be taken from the nuclear data sheet for this nuclide. The default is zero, but 2% is a realistic number.

The first six **Nuclide Flags** are used to show how the nuclide was produced. For example, **Thermal Neutron Activation (T)** indicates that this nuclide is produced when the parent nuclide absorbs a slow neutron. This can be helpful in organizing reports by nuclide category. More than one flag can be checked. Libraries produced with NuclideNavigator II or later will already have these flags set. For other libraries, consult a reference for the proper settings.

The **No MDA Calculation** and **Activity Not in Total** flags are not used in MAESTRO. The **No MDA Calculation** flag indicates that the nuclide will not be reported unless present in the spectrum. If this is not checked, the MDA value will be printed if the nuclide is not present in the spectrum.

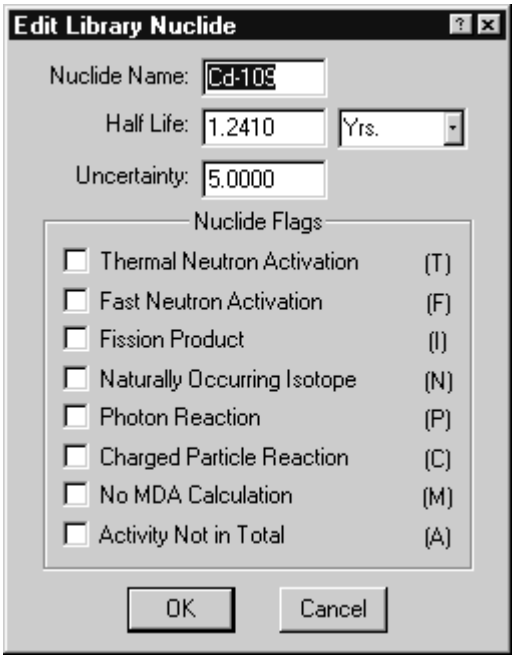


Fig. 122. Edit or Manually Add Nuclide Name.

The **Activity Not in Total** flag indicates that the activity for this nuclide will not be included in the total activity for this sample.

7.2.3.1. Manually Adding Nuclides

To manually add a nuclide to the library list:

1. Locate the nuclide immediately *below* the desired insertion position, and click once to highlight it.

2. Next, click on the manual **Insert...** button to open the Edit Library Nuclide dialog. The dialog will be blank.

3. Fill in the name and half life as well as any other inputs and click on **OK**.

7.2.3.2. Deleting Nuclides from the Library

To remove a nuclide from the library, click on the nuclide, then on **Cut**. This will remove the nuclide from the list. In addition, it will activate the gray **Paste** button at the bottom of the nuclide list, and change its label to include the name of the cut nuclide. This is illustrated for ^{152}Eu in Fig. 123.

Fig. 123. Cut Nuclide is Ready to Paste.

7.2.3.3. Rearranging the Library List

The order of the nuclides in the library is the order in which they are listed on the report. Nuclides can be rearranged in the library file list by cutting and pasting them into a different location. To move a nuclide to a new position in the list, highlight the nuclide to be moved; **Cut** it from the list; locate the nuclide immediately *below* the desired new position and click once on that nuclide to highlight it; then click on the **Paste** button (which will be labeled with the name of the **Cut** nuclide). The **Cut** nuclide will be inserted in the space above the highlighted nuclide.

Several nuclides can be cut at one time from the list, then pasted back into the list into a different order. Cut nuclides remain queued up for pasting, last one first, according to the nuclide name on the **Paste** button.

To move a nuclide to the end of the library list, **Cut** the nuclide from the list, highlight the **--end--** entry, and click on the **Paste** button**.**

7.2.3.4. Editing Nuclide Peaks

When a nuclide is selected in the working library file, the right half of the Editing dialog shows the peak list. Note the column headers, **Rank**, **Energy**, and **Percent**. To sort the peak list by a particular parameter in the list, click on the appropriate header.

To edit a peak, either double-click on the peak in the right-hand list, or click once on it, then click on the **Edit** button. This will open the Edit Library Peak dialog (Fig. 124). The **Energy (keV)**, **Gammas per 100 Disintegrations**, **Photon Flags**, and **Peak Flags** will already be listed.

The **Photon Flags** and **Peak Flags** are not used in MAESTRO. The **Photon Flags** are used to show the origin of the peak. Only one can be selected at a time. **Gamma Ray (G)** and **X-Ray (X)** mean the peak energy is due to a nuclear or atomic transition, respectively. **Positron Decay (P)** is used for the 511-keV peak. **Single-Escape (S)** peaks are peaks for which a single 511-keV photon has escaped the detector. This can only occur for full-energy peaks above 1.022 MeV. **Double-Escape (D)** peaks are peaks for which two 511-keV photons have escaped the detector. Both single- and double-escape peaks are broader than gamma-ray peaks. Neither can be used for activity calculations because the intensity of the peak is not related directly to the intensity of the full-energy peak. Nonetheless, these can be included in the library to account for the peak in the spectrum.

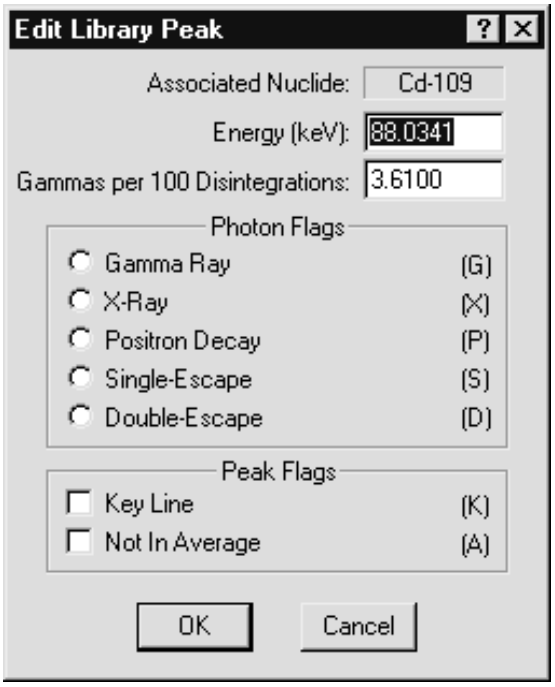


Fig. 124. Edit or Manually Add Library Peak Values.

The **Not In Average (A)** flag in the **Peak Flags** section of the dialog should be set for these peaks. All the peaks marked as **Key Line (K)** must be present before the nuclide will be listed as present on the report. If no lines are marked as key lines, the nuclide will be listed as present if the first line is in the spectrum.

7.2.3.5. Adding Nuclide Peaks

To add a peak, click on the peak *just below* the desired insertion point in the peak list, then click on **Insert...**. This will open the Edit Library Peak dialog; all the fields will be blank. Enter the necessary information for the peak and click on **OK**.

7.2.3.6. Rearranging the Peak List

The entries in the peak list can be rearranged with the **Cut** and **Paste** buttons. Several peaks can be cut at one time from the list, then pasted back into the list into a different order. Cut peaks

remain queued up for pasting, last one first. Each relocated nuclide will retain its energy and counts/sec values, but will be assigned a **Rank** number according to its new position. Click on the peak *just below* the desired insertion point in the peak list, then click on **Paste**.

7.2.3.7. Saving or Canceling Changes and Closing

To save this modified library file, click on the control menu, then **Save Library As...**. Either use the current filename (which will overwrite the previous values) or assign a new filename, then click on **Save**. The Library Editor will assign the default `.LIB` extension. To save this as an `.MDB`-format library, select the `.MDB` format from the **File Type** droplist at the bottom of the dialog. To exit the edit session, click on the control menu, then **Close**.

To abandon any changes and restore the library file to its condition before editing, click on the control menu, then **Close**. A dialog will open asking if the changes should be saved; select **No**.

7.2.4. Print Library

This feature allows you to print out the library contents from the **Services** menu. The dialog shown in Fig. 125 will prompt the user to choose whether the printout is ordered **by Nuclide** or by **Energy**, and whether the output will go to a **Printer** or **to File**. If the output is directed to a printer, you can click on **Setup...** to display the standard printer selection and setup dialog (see Section 4.1.6). Answer the prompts and click on **OK**. For output to a file, you are asked for a file name for the output.

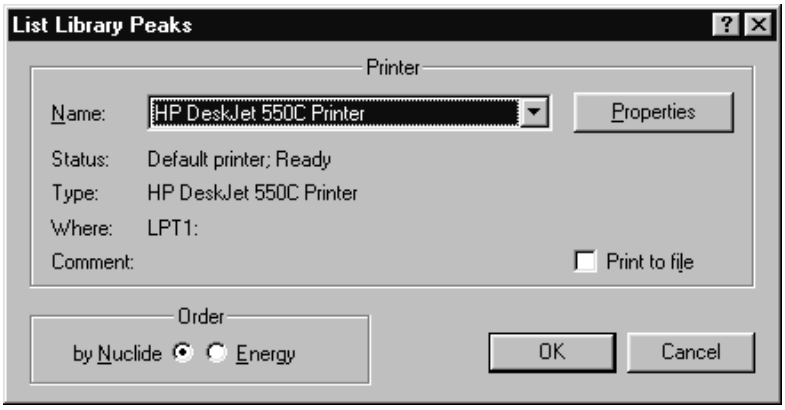


Fig. 125. Print Library.

7.2.5. Close

This closes the GammaVision Library Editor and returns control to Windows. If the library has been changed but not saved, a warning message will be displayed. To abandon any changes and restore the library to the condition before editing, exit without saving.

7.2.6. About...

This displays a window (Fig. 126) containing general information about the library editor that will be of use should you need technical support.

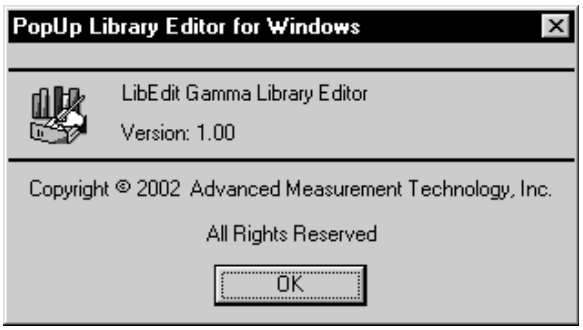


Fig. 126. About LibEdit.

7.3. TRANSLT

The TRANSLT program (**TRANSLT.EXE**, located in **c:\Program Files\MAESTRO**) translates several different text files to and from **.SPC** or **.CHN** files. All operation is controlled from the command line. The command line is:

TRANSLT [-type] inname [[-type] outname] [-w] [-nc] [-col n] [-ni] [-nh] [-i]

where:

type

chn	The **inname** file is in CHN format.
spc	The **inname** file is in SPC format.
txt	The **inname** file is in ASCII text format.

The default is based on the filename extension and the **i** switch. Both **chn** and **spc** cannot be used together.

inname The input spectrum file, no default; default extension is **SPC**. If the input file is a **.TXT** file, it must contain the live and real time in the following format:

Real Time 240
Live Time 120

Both values are in seconds.

The header information in the **.TXT** file will be converted and stored in the **.SPC** file if it is in the correct format. The correct format for the **.TXT** input file is the same as the **.TXT** format created as the output file.

type	**chn**	The **outname** file is in CHN format.
	spc	The **outname** file is in SPC format.
	txt	The **outname** file is in ASCII text format.

outname The output spectrum file. The default is the **inname** with the extension changed. If the **outname** is not given, the spectrum file will not be overwritten by the default name. The length of the spectrum file converted from text will be the next higher power of two with the surplus channels set to 0.

w Set the format output to 128 characters per line; default is 70 characters per line.

nc Do not print channel as first number in line; default is to print the channel number. The channel number is followed by a colon (:) to separate it from the data.

col n Number of data columns is **n**; default is 5. Error returned if line width will exceed available space.

ni Do not write acquisition or analysis information in output file; default is to write this information.

nh Do not write header information in output file; default is to write this information.

i Import a text file and save as **.SPC** (or **.CHN**) file. If one filename is given, default is to convert that file to the other format, i.e., for **AAA.SPC**; the output will be **AAA.TXT**. If two filenames are given, the default is to convert the spectrum to text. The **.TXT** file will be overwritten even if the **.SPC** file is not located.

An example is:

```
TRANSLT -SPC GOODSPEC -TXT TEXTSPEC -ni -nh -col1
```

This will make a text file of one column with no header, no analysis information, and one channel per line.

For more comprehensive file-translation capabilities, use our DataMaster Spectrum File Format Translator for Microsoft Windows 95/98/2000/NT (B48-B32), which allows you to import 16 spectrum file formats (including **.CHN** and **.SPC**) and translate them into 10 formats.

APPENDIX A. STARTUP

To start MAESTRO from the Windows Taskbar, click on **Start**, **Programs**, **MAESTRO 32**, and **MAESTRO for Windows** (see Fig. 127). You can also start it by clicking on **Start**, **Run...**, and entering a command line in the **Run** dialog, with or without arguments as described below.

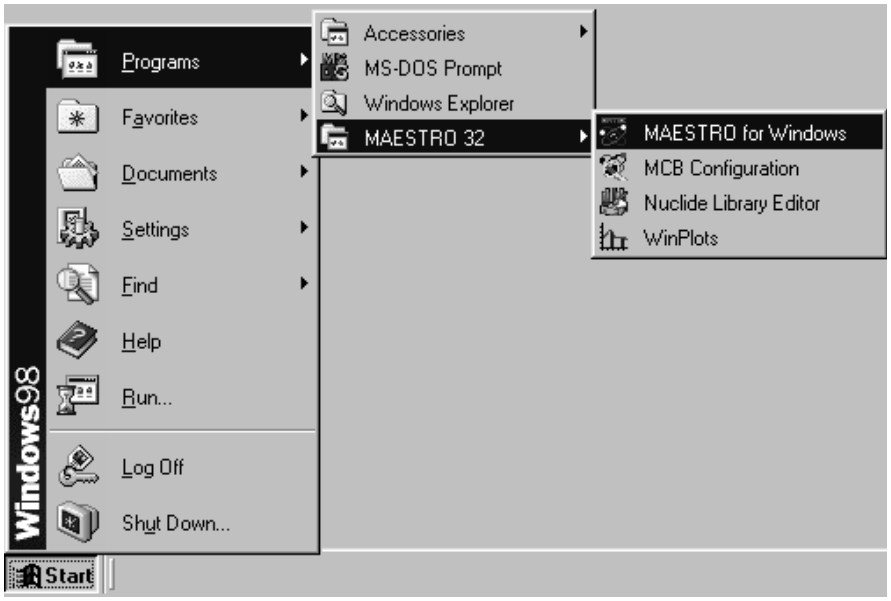


Fig. 127. Starting MAESTRO.

A.1. Command Line Options

The form of the command line for invoking MAESTRO is:

```
MCA32.exe  -P listname  -L file.lib  file.job  -B
```

All of the arguments are optional; one or more can be omitted. Thus, at a minimum, MAESTRO can be executed without any arguments at all, in which case certain defaults apply for the Detector list and nuclide library, as described below. As shown, there are three possible command line arguments:

`-P listname` Optionally uses listname as the Detector pick list name. The pick list name must be 5 characters or less. If a pick list is not specified, **`M32MCA`** is used by default. The current pick list name is displayed above the Pick List column in the Detector List Editor dialog (**Services/Edit Detector List...**). If the pick list name specified by **`pick`** does not exist then one is created. This new list will contain all available detectors included in the Master Detector List. If the pick list already exists, only the detectors defined in that list are displayed in the Detector droplist on the Toolbar. Changes made to the pick list with the **Edit Detector List...** command are stored with the active pick list filename. Therefore, to create multiple pick lists, use the **`-P`** option with the pick list name and then edit the list to contain only the desired Detectors. The contents of the list can be overridden with

the Edit Detector list function. The new list will be stored for use the next time this instance of MAESTRO is run.

-L file.lib Pre-loads the nuclide library "**file.lib**" instead of the default library **LIB.lib**. This can include a path specification, which will override the library path specified on the Directories tab under **File/Settings...** (see Section 4.1.1.4).

file.job Begins execution of the job "**file.job**" immediately.

-B Starts up with an open buffer window rather than searching for a valid Detector.

Certain defaults apply if any one or more of these arguments is omitted. The initial Detector list is named **M32MCA.CFG**. The nuclide library is assumed to be **LIB.lib** by default, or the last library used. And no JOB is automatically executed unless the "**FILE.JOB**" argument is included.

A.2. Programs

MCA32.EXE is the main program for the MAESTRO application.

MCBCON32.EXE is the Detector configuration program for the local PC and the entire network. It only needs to be run manually if MCBs have been added to the network configuration since MAESTRO was installed. All machines to be included in a network configuration should have MCBSER32 running (see the MCB Properties manual).

MCBSER32.EXE is the communications link between the network and the local Detectors. To use MAESTRO to access Detectors attached to a PC elsewhere on your network, make sure MCBSER32 is running on that remote PC (see the MCB Properties manual).

APPENDIX B. FILE FORMATS

This appendix describes the file structure for the MAESTRO program files. See the *ORTEC Software File Structures Manual for DOS and Windows® Systems* for complete descriptions of the formats for these files, including **.SPC** and **.CHN** files. Section B.2 includes two program examples that show how to access the spectrum files.

B.1. MAESTRO File Types

B.1.1. Detector Files

.CFG "ConFiGuration"; System Detector configuration information used by **MCA32.EXE**; binary format.

.CXT "ConteXT"; For each Detector/Device a context file is automatically created to remember all extra information required for analyses, calibration, and other calculations.; binary format.

B.1.2. Spectrum Files

.CHN "CHaNnels"; MAESTRO-style spectral data file; binary format.

.SPC "SPeCtrum"; Spectrum with full analysis settings, calibration, descriptions, and other parameters; "Inform" type binary format.

.ROI "ROI"; channel pairs created by the **ROI/Save File...** function; binary format.

B.1.3. Miscellaneous Files

.LIB "LIBrary"; nuclide library; "Inform" style binary format.

.RPT "RePorT"; output of analysis engine; ASCII text.

.TXT "TeXT"; general ASCII text files used by **File/Print...**.

.JOB ASCII text providing commands for the **Services/JOB Control...** function.

B.2. Program Examples

The following examples show how to read **.CHN** data files and **.ROI** region-of-interest files. These are simple program segments to illustrate the programming details needed.

B.2.1. FORTRAN Language

This section contains two routines; one to access the **.CHN** files and one to access the **.ROI** files.

B.2.1.1. .CHN Files

```
C This program prints the header data from a GammaVision data  file
C and the contents of a channel.
C
      INTEGER*2 TYPE,MCA,SEG,STRTCH,LNGTDT,SPCOUI(64)
      INTEGER*2 BEGREC,ENDREC
      INTEGER*2 TLRTYP,IS
      INTEGER*4 SPCIN(32),LVETME,RLTIME
      REAL*4 ENG(2),FW(2),X1
      CHARACTER*1 SRTTME(4),SRTSEC(2),SRTDTE(8),OUTPUT(30)
C
C    START
C
      WRITE(0,100)
100   FORMAT(29X,'SPECTRUM PRINT ROUTINE',//)
C  Open the spectrum file
      OPEN(1,FILE=' ',STATUS='OLD',ACCESS='DIRECT',RECL=32)
C  Read the first 32 bytes (first record) from the file
      READ(1,REC=1) TYPE,MCA,SEG,SRTSEC,RLTIME,LVETME,
     1 SRTDTE,SRTTME,STRTCH,LNGTDT
C  Check to see if the first word is a numeric -1, if not
C      then quit
      IF(TYPE.NE.-1) GO TO 1000
C  It's good, so write out all the data from the header,
C  note that the start time is split into two parts
      WRITE(0,150) TYPE,MCA,SEG,RLTIME/50,
     1  LVETME/50,SRTTME,SRTSEC, (SRTDTE,STRTCH,LNGTDT
150   FORMAT(' TYPE = ',I4,' MCA # ',I2,' SEGMENT # ',
     1  I3,/,' REALTIME = ',I10,' SECONDS, LIVETIME = ',
     2  I10,' SECONDS',/,' DATA COLLECTED AT ',2A1,':',2A1,
     3  ':',2A1,' ON ',2A1,'-',3A1,'-',2A1,/,
     4  ' STARTING CHANNEL = ',I6,' NUMBER OF CHANNELS = ',
     5  I6,//)
C  The first trailer record is after the last channel data.
C  Divide the length by 8, because there are 8 channels per
C  record.
      LREC=3+(.CHNLEN-1)/8
C  Read the first trailer record. TLRTYP is the record type
C  The variables IS and X1 are dummys maintain the position
C  in the file.
      READ(LUN,REC=LREC,ERR=100)TLRTYP,IS,ENG(1),ENG(2),
     1  X1,FW(1),FW(2)
      WRITE(0,160) ENG,FW
160   FORMAT(' ENERGY ZERO = ',E14.8,/,' ENERGY SLOPE = ',
     1 E14.8,/,' FWHM ZERO = ',E14.8,/,' FWHM SLOPE = ',E14.8)
```

```
C  Ask the user for the channel number to print out
      WRITE(0,200)
200   FORMAT(` Enter channel number: `,\)
C  Get the channel number
      READ(0,210) I.CHNNL
210   FORMAT(I5)
C  Calculate the block of 8 channels that this one is in.
C  There are 8 channels in a record of 32 bytes.
      CHANEL=I.CHNNL-1
      ENDREC=CHANEL/8.
      BEGREC=CHANEL/8.
C  This is only one record in this example, but could be any
C  number of records. The 2 is the offset past the header
C  and the records start at 1. So the first data record is 2.
      DO 450 I=BEGREC+2,ENDREC+2
C  Read the 8 channels
        READ(1,REC=I) (SPCIN(K),K=1,8)
C  Print the 8 channels along with the channel number of
C  the first channel
        WRITE(0,410) 1+8*(I-2),(SPCIN(K),K=1,8)
410     FORMAT(1X,I5,8I9)
450   CONTINUE
      CLOSE(1)
1000  STOP
      END
```

B.2.1.2. .ROI Files

```
INTEGER*2 LUNROI,LSTREC,IBEGIN,IEND
C
      WRITE(0,100)
100   FORMAT(29X,'ROI PRINT ROUTINE',//)
C  Open the ROI file
      OPEN(1,FILE=' `,STATUS='OLD',ACCESS='DIRECT',RECL=2)
C  Read the ROIs
      I=0
      IROI=1
C  Add 2 to skip past the header
200   READ(1,REC=I+2) IBEGIN
C  If the entry is 0 then this is the end of the list
      IF(IBEGIN.LE.0) GO TO 1000
C  If the beginning is there then the end is also
      READ(1,REC=I+3) IEND
C  But its one too many
      IEND=IEND-1
C  Write them all out
```

```
      WRITE(0,220) IROI,IBEGIN,IEND
220   FORMAT(' ROI # ',I3,' START ',I6,' STOP ',I6,)
C  Add 2 to I to advance past the begin and end numbers
      I=I+2
      IROI=IROI+1
C  Keep going until we run out of numbers
      GO TO 200
1000  STOP
      END
```

B.2.2. C Language:

```
/*************************************************************/
/* Sample program compatible with Microsoft and Borland C    */
/* to read header and channel data from a .CHN data file.    */
/*************************************************************/

#include <stdio.h>
#include <stdlib.h>

#define .CHN    -1

main(argc,argv)
    int  argc;
    char *argv[];
{
    char           acq_time[8],  /* buffer for time, date */
                   month[4];     /* buffer for month string */
    short          f_type;       /* .CHN file type */
    unsigned short chan_offset,  /* beginning channel number */
                   count,        /* loop counter */
                   mca_num,      /* MCA number */
                   num_chans,    /* no. of data channels */
                   num_writ,     /* no. of bytes written out */
                   segment,      /* segment number */
                   year,         /* acquisition year */
                   day,          /* acquisition day */
                   hour,         /* acquisition hour */
                   minute,       /* acquisition minute */
                   second,       /* acquisition second */
    long int       livetime,     /* 20ms tics of livetime */
                   real_time,    /* 20ms tics of realtime */
                   chan_data;    /* stores channel data */
    FILE           *f_pointer;
    if ( argc != 2 )
    {
        printf("USAGE: readchn filename.chn\n");
        exit(1);
    }
```

```
f_pointer = fopen( argv[1], "rb" );

/*********************************************************/
/*                    Header Data                        */
/*         Output header info from .CHN file             */
/*********************************************************/

/* Read fileype -1 (.CHN) */

fread( &f_type, sizeof(f_type), 1, f_pointer );
if ( f_type != .CHN)
{
    printf("Not a valid file\n");
    exit(1);
}

fread(&mca_num, sizeof(mca_num), 1, f_pointer); /* MCA # */
fread(&segment, sizeof(segment), 1, f_pointer); /* seg # */
fread(acq_time, sizeof(char), 2, f_pointer);    /* start time */

acq_time[2] = 0;
seconds = (short)atoi( acq_time );

fread(&realtime, sizeof(realtime), 1, f_pointer); /* 20 ms tics */
fread(&livetime, sizeof(livetime), 1, f_pointer); /* 20 ms tics */
fread(acq_time, sizeof(char), 3, f_pointer);      /* start day */

acq_time[2] = 0;
day = (short)atoi( acq_time );

fread(month, sizeof(char), 4, f_pointer);         /* start month */

month[3] = 0;

fread(acq_time, sizeof(char), 2, f_pointer);      /* start year */

acq_time[2] = 0;
year = 1900 + (short)atoi(acq_time);

fread(acq_time, sizeof(char), 1, f_pointer);      /* century */
if ( acq_time[0] >= '0' )
{
    year = year + (acq_time[0] - '0') * 100;
}

fread(acq_time, sizeof(char), 3, f_pointer);      /* hour */

acq_time[2] = 0;
hour = (short)atoi(acq_time);

fread(acq_time, sizeof(char), 2, f_pointer);      /* minute */
```

```
    acq_time[2] = 0;
    minute = (short)atoi(acq_time);

    fread(&chan_offset, sizeof(chan_offset), 1, f_pointer); /* offset */
    fread(&num_chans, sizeof(nuM_chans), 1, f_pointer);     /* # chans */

    printf("FILE TYPE:          %d, MCA# %6d\n", f_type, mca_num);
    printf("SEGMENT:            %d\n", segment);
    printf("REALTIME:           %d SECONDS\n", realtime / 50);
    printf("LIVETIME:           %d SECONDS\n", livetime / 50);

    printf("DATA COLLECTED AT:  %2u:%2u:%2u ON %2u-%s-%4u\n",
            hour, minute, second, day, month, year);

    printf("STARTING CHANNEL:   %d\n", chan_offset);
    printf("NUMBER OF CHANNELS: %d\n", num_chans);

    /*********************************************************/
    /*                   Channel Data                        */
    /*          Output channel data from .CHN file           */
    /*********************************************************/

    printf("CHANNEL DATA:\n");

    for (count = 0; count < num_chans; count++ )
    {
        if ( (count % 6 == 0) )      /* 6 channels per line */
            printf("\n%7d", count);  /* with channel number */

        fread(&chan_data, sizeof(chan_data), 1, f_pointer );
        printf("%11d", chan_data);
    }

    fcloseall();
    exit(0);
}
```

APPENDIX C. ERROR MESSAGES

Errors are displayed in warning boxes, or in some cases in the information line at the bottom of the window.

Acquisition failure.
For some reason an acquisition function failed from a `.JOB` file.

Already started.
Detector already active when a START acquisition command was issued.

Altering Detector data.
Restoring data to a Detector would destroy the data already there.

Amplifier not pole-zeroed.
Warning from a 92X indicating that the Detector should be pole zeroed.

Attempt to dynamically link to a task.
The Windows Error 5 was detected.

Auto PZ aborted.
The 92X Auto PZ function was aborted (by **<Esc>**).

Buffer and Detector not same size.
Buffer and Detector memory incompatible.
Error when trying to restore data which does not match the Detector configuration.

Calibration per channel wrong.
Error when trying to calibrate spectrum, arising whenever the calibration slope would be 0, negative, or greater than 100 units per channel.

Can't Find Any More ROIs.
Attempting to index to the next ROI in a direction for which no more ROIs can be located.

Can't load/read library file.
Attempt to open or read the library file resulted in some kind of file I/O error, usually because the file doesn't exist, but also possibly because the disk is defective.

Can't run protected mode application in real mode.
The Windows Error 18 was detected.

Can't run second instance of this program.

The Windows Error 16 was detected. This is due to using non-shareable DLLs.

Can't get valid spectrum data.

The system could not supply valid data. Detector communication failure, most likely resulting from a timeout (the Detector failed to respond within a reasonable period of time).

Command was ignored.

The MCB ignored the command. This might be a valid response depending on the MCB type.

Could not properly fit the peak.

Function requiring a fitted peak could not obtain an acceptable peak, probably because of too few counts, too narrow or non-Gaussian peak shape, or bad statistics such as calculated sigma-squared less than zero.

Couldn't get background subtracted ROI.

A function requiring a background subtracted ROI couldn't obtain such, probably because there was no ROI at the point specified, or mightbe because there weren't statistically significant counts above background.

Default Printer Failure

The REPORT or PRINT function was aborted because the default system printer has not been properly setup. Go to **Windows/Control Panel/Printers**, install the appropriate printer, and select it as outlined in the Microsoft Windows documentation.

Detector #.. ; ..... ; Error ... (Macro) ... (Micro)

An unresolved error originating in the Detector. The offending Detector command is shown, together with the macro and micro error codes. If the error persists, the error codes should be recorded and the factory should be contacted.

Detector busy with other tasks, not responding.

This indicates the Detector was unable to respond within a certain time limit due to other activities, such as multiple instances of MAESTRO accessing the Detector at the same time or otherwise heavy use of the Detector interface.

Detector does not support Field Mode (Job Error 19)

An attempt was made to execute the LOOP_SPECTRA or VIEW command on a Detector that does not support Field Mode.

Detector Error!

The selected Detector could not be STARTed or STOPped due to some unresolved error condition.

Disk, network or firmware I/O error.

An I/O error was detected.

Detector locked by ???.

An attempt to modify the contents of a locked Detector was made. The person named (???) has locked the Detector.

Do you want to save buffer?

A function that would destroy the buffer (such as COPY or EXIT) queries you unless the buffer has not been modified since last being saved.

DOS Application.

The Windows Error 13 was detected. An attempt was made to run a DOS application in Windows.

Error modifying ROI on this Detector.

The ROI cannot be modified on locked Detectors or on Detectors that are collecting data.

Error opening file.

If trying to write a file, this would indicate a disk controller problem such as a full disk. If trying to read a file, this would indicate that the filename specified could not be found.

Error reading file -- STRIP aborted.

Could not read the file requested for stripping.

Error reading file.

File read error is usually a result of damaged media.

Error writing file.

File write error is usually a result of damaged media or full disk.

EXE for an earlier version of Windows.

The Windows Error 15 was detected.

Failure obtaining ROI (or Peak).

A function that requires a defined ROI (or peak, in the case of the **Calibration...** function) when the Marker is not placed in a channel with an ROI bit set (and if a peak is not very close by).

Failure of Detector function.

This error arises from a JOB that encounters an error when trying to access an Detector.

File already exists!

If the file output function requested would write a file with the same name as another file that already exists, you are prompted for confirmation of the operation by this warning. See also "OK To Overwrite Existing File?"

File is wrong size -- Can't STRIP.

The STRIP function requires a compatible file for stripping from the spectrum in memory; i.e., must contain the same number of channels.

File not found.

The requested file could not be found. This is Windows Error 2.

Fine gain is at limit of ...

This message appears in the Marker Information Line when an attempt is made to change the gain setting in some MCBs (e.g., 92X) with the keyboard function, but gain cannot be decreased or increased any further.

Firmware communication failure.
Firmware reported error.

The MCB firmware did not respond or responded with an error. See hardware manual for meaning of message.

Hardware failure!

This message appears as the result of an Detector execution error with microcode 137, indicating a hardware failure. See hardware manual for more details.

High voltage not enabled.

START was attempted on a MCB while the high voltage was not enabled.

Illegal Detector.

The Detector number for the requested function was not identifiable as part of the active configuration.

Illegal entry.
The input to a dialog box is not correct.

Incorrect Windows version.
The version of Windows does not support this program; use a later version of Windows.

Insufficient memory for detector descriptions.
Insufficient memory for buffer.
The memory buffer could not be created due to insufficient available memory in the system. Sometimes this error can be eliminated by attempting the buffer operation again, but this is not recommended due to the marginal state of the system, which might result in other errors.

Invalid EXE file.
The requested file was invalid. This is Windows Error 11.

Invalid command or missing argument.
An incorrect command was entered in a `.JOB` file. This is JOB Error 4.

Invalid Detector input selection.
The specified Detector number is incorrect. That is, there is no corresponding Detector for that number.

Invalid File Format!
A function to recall a file could not obtain data in the proper format.

Invalid library file.
An attempt was made to load a nuclide library from a file that was not in the proper format.

Invalid Start Record.
No valid Start Record file could be found to provide the start date/time for the Detector.

Invalid loop count.
An incorrect loop count was entered in a `.JOB` file. This is JOB Error 7.

Invalid start date/time.
The start date and time returned from the MCB hardware was incorrect. This might be due to a loss of battery power in the MCB.
Invalid start record.
The start record for this Detector contained invalid information.

Job Aborted or Premature EOF.

A JOB was aborted by the user, or an end-of-file was encountered while trying to obtain a command from the executing `.JOB` file. This is JOB Error 1.

Job Error.

A generic error message indicating that an error was encountered while executing a `.JOB` file. Usually some explanatory phrase is given.

Job waiting for end of acquisition.

The JOB is waiting for a Detector to stop counting.

Job waiting for completion of program ???.

The JOB is waiting for the stated program to end.

Library requires separate ....

This is Windows Error 6.

Library too large to load.

An attempt was made to use a large library for the working library. Use the Nuclide Library Editor program, (**Start**, **Programs**, **MAESTRO 32**, **Nuclide Library Editor**; see Section 7.2), to make a smaller working library. A large library can be used as the master library in the edit function to create a working library.

MCBCIO error.

This error indicates a software problem.

Must choose separated peaks!

This error arises when a calibration is attempted using two identical or too-closely-positioned peaks.

Must have a value greater than zero!

The input value must be positive and non-zero.

Must select 92X-type Detector!

This error results from an attempt to perform a function available only for 92X-type Detectors.

Must select OCTÊTE-type Detector!

This error results from an attempt to perform a function available only for OCTÊTE-type Detectors.

Need an ROI at the desired peak location.
The Stabilizer function requires a valid ROI at the desired peak.

No buffer to restore from!
There is no data in the buffer to use.

No close library match.
The REPORT function could not obtain a library entry close enough the located peak.

No File Name.
A file function was requested without specifying the filename adequately.

No more peaks, or can't reach.
A peak search was attempted in a direction where no more can be found.

No peaks found.
The peak search function could not find any valid peaks in the spectrum.

No ROI There To Clear.
The **ROI/Clear** function (**<Delete>**) requires at least one channel at the marker with the ROI bit set.

Not Allowed During Acquisition!
An execution error (micro 135) arising from the Detector, indicating that the Detector command is not allowed while acquisition is in progress.

Not Allowed During Current Mode!
An execution error arising from the Detector (micro 136), indicating that the Detector command attempted is not allowed in the current mode of operation.

Not Allowed while Job running!
An attempt was made to execute a function on a Detector while a JOB was running on that Detector.

Not enough memory -- STRIP aborted.
The STRIP function temporarily allocates enough memory to read the file, but the allocation failed in this case, probably due to insufficient available memory in the system. The STRIP function is discontinued.

Not enough memory for COMPARE.

The Compare mode could not be executed due to insufficient memory for the second spectrum.

OK to overwrite '...' ?

A file output function discovered that the specified filename already exists, and will only overwrite the file after you confirm your intentions. See also "File already exists!"

Out of memory

There is not enough memory in the PC to perform this function. This is Windows Error 0.

Path not found!

The specified path for the file was not found. This is Windows Error 3.

Peak rejected for asymmetry.

Peak statistics could not be obtained for the function due the calculated non-Gaussian asymmetry of the obtained peak.

Pick list is outdated!

The Master Detector List has been changed by someone on the network since the last time the Detector pick list on this copy of MAESTRO was edited.

Preset already reached.

Acquisition START was attempted on a Detector or Segment that had already satisfied the preset condition(s) in some way.

Presets not programmed to Detector correctly.

The program attempted to change the presets in the Detector but was unable to verify the changes.

Presets can't be changed during acquisition.

Changes in the preset condition(s) are not allowed while the Detector is actively acquiring.

Problem with Buffer.

A JOB error resulting from some problem with the buffer, usually indicating insufficient memory to create or enlarge the buffer as needed.

Problem with Calculation.

A JOB error resulting from a problem with a calculation.

Problem with File.
A file input/output error encountered while executing a JOB.

Problem with LOOP.
The LOOP statement could not be executed properly in a JOB.

Problem with RECALL.
The RECALL statement could not be executed in a JOB.

Problem with REPORT.
The REPORT function could not be exercised in a JOB.

Problem with RUN.
The specified program could not be RUN from a JOB.

Problem with SAVE.
The SAVE function could not be executed in a JOB.

Sample Changer Hardware Failure.
The sample changer hardware handshake failed in some way; usually the result of too much time before SAMPLE READY is obtained.

There are no stored spectra to view (Job Error 20)
An attempt was made to execute the LOOP_SPECTRA or VIEW command on a Detector that does not have any stored spectra.

The WAIT program was not started by MAESTRO (Job Error 23)
All programs waited for have to be started by MAESTRO.

Unable to CALL.
A JOB error resulting from a problem with the CALL function (usually because the file does not exist).

Unable to COMPARE files of different sizes.
The COMPARE function requires compatible files.

Unable to open file -- STRIP aborted.
The STRIP function is aborted if the file cannot be read.

Unable to open file for COMPARE.
The COMPARE function is aborted if the second spectrum cannot be read.

Unable to read specified file.

A JOB error resulting from a problem with the RECALL function (usually because the file does not exist). JOB Error 3.

Unable to RUN non-EXE file.

An attempt was made to execute a non-executable file. JOB Error 6.

Unknown command.

An unrecognized command was found in a `.JOB` file. Check spelling. JOB Error 5.

Unknown error from MCBCIO.

An error occurred with the MCB communications, but the error was not recognized.

Unable to strip Detector memory.

The stripping function must be performed in the buffer.

Warning 128.
Warning 64.
Warning 8.

All three of the above messages are the result of Detector START or STOP warnings and are hardware-dependent.

Warning: Buffer was modified.

When the MAESTRO program is being closed, this message appears if the buffer spectrum has been modified but not yet saved to disk. This gives you the option of saving the buffer (instead of losing it) before closing the application.

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